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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

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BIRMINGHAM CORPORATION TRAMWAYS SLEEPERED TRACK.

By F. S. WARREN
(*Permanent Way Engineer, Birmingham Corporation Tramways*).

The Corporation of Birmingham in 1914 obtained Parliamentary powers to construct a tramway track on an independent right of way, with rails laid on the sleeper principle, in the north-eastern district of the city, along a new thoroughfare known as Tyburn Road. Owing to the war the project had to be temporarily abandoned, but in 1920 the enormous industrial developments at the new works of the Dunlop Rubber Company and other factories in the vicinity led to its revival. The total length of route sanctioned comprises two miles, six furlongs, 1·81 chains of double track, and of this one mile, six furlongs, 7·73 chains has been completed, the present terminus being at Holly Lane, quite close to "Fort Dunlop," the portion between Holly Lane and Tyburn being left in abeyance.

The city terminus of the route is at Steelhouse Lane, and the new track commences at the junction of Gravelly Hill and Slade Road with a double junction. After passing through a deep cutting of red sandstone thirty feet high and 300 yards in length (Fig. 2), which necessitated extensive blasting, it traverses open country and fields for the remainder of the distance.

Fig. 1.—Sleepered Track of Birmingham Corporation Tramways in Tyburn Road.

The general manager, Mr. A. Baker, was responsible for the execution of the work, which was carried out by direct labour under the supervision of the Permanent Way Engineer. The work was commenced by the Permanent Way Department on January 13, 1920,

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and notwithstanding the abnormally wet weather and the difficulty experienced in obtaining labour and materials, the work was finished and service was commenced on May 13, 1920, four months from the commencement.

Generally speaking the route is moderately straight with no excessive gradients, the steepest gradient being 1 in 70, and the sharpest curve 300 ft. radius.

Fig. 2.—Cutting at commencement of Tyburn Road Sleepered Track, Birmingham.

The distance from centre to centre of the tracks on the straight is 7 ft. 6 in., giving a clearway of four feet, the gauge of the track being 3 ft. 6 in. The total width of the road occupied by the tramway is 27 ft.

It is the intention of the Corporation to construct carriageways on each side of the tramway track, 24 ft. wide, with footpaths 14 ft. wide, giving a total width, inclusive of the tramway, of 103 ft. On one portion of the route this has been accomplished (as shown in Fig. 1), the work having been carried out during the winter months by "unemployed" labour under the direction of the city engineer and surveyor, Mr. H. H. Humphries, M.I.C.E.

The rails used are of special design (Fig. 6), and are five inches deep with a $5\frac{1}{2}$ in. flange. They weigh 99 lb. per yard, the head being the same as the British Standard Section No. 4. This head was adopted to facilitate fishing up to the existing British Standard Section used throughout the system. The rails were rolled by Messrs. Steel, Peech and Tozer, of Sheffield, and the composition of the steel is as follows—

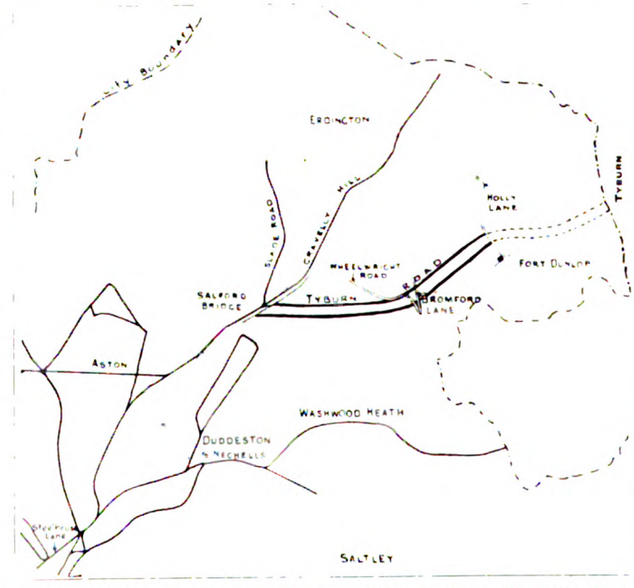
Carbon	... ...	·4 per cent. to	·55 per cent.
Phosphorus	... ...	·08 ,,	
Manganese	... ...	·7 ,,	to 1·00 ,,
Silicon	... ...	·1 ,,	
Sulphur	... ...	·08 ,,	

The fishbolt holes in the rails are oval ($1\frac{1}{8}$ in. by $1\frac{1}{2}$ in.). This allows for a space of one quarter of an inch being left at the joints for expansion and contraction. During the extremely hot summer experienced in 1921 this proved to be correct. The fishplates weigh 18 lb. per pair, and are 1 ft. 4 in. in length, each pair being drilled for four 1 in. diameter fishbolts fitted with cross slit lock nuts. The tiebars are of flat steel section, each bar being held in position by four nuts and washers, one on each side of the web of the rail. The tiebars are spaced 12 ft. apart.

The bonds are of the flexible type, 4/0 S.W.G., with $\frac{7}{8}$ in. pin terminals. They are fastened into the flange of the rail, two to each joint, so as not to interfere with the tightening up of the fishbolts. Cross and intercross bonds were fixed at the usual intervals.

Fig. 3.—Slag Foundation of Sleeper Track, Birmingham Tramways.

In laying the permanent way the ground was first excavated to the required depth, but owing to its boggy and waterlogged nature it was decided to run a 6 in. perforated drainpipe down the centre of the clearway (Fig. 7) at a depth of approximately 3 ft.



Map of North Eastern Section, Birmingham Corporation Tramways, showing location of Sleeper Track.

from the top of the rail. Outlets were provided at intervals either into ditches or sewers, the trench in which the perforated pipes were laid being filled up to the correct level with $2\frac{1}{2}$ in. clean blast furnace slag.

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The foundation of the track, approximately 16 ft. wide to allow for a double line, was then hand pitched with 6 in. blast furnace slag covered off with 2 in. slag (Fig. 3).

The sleepers, which are of creosoted deal 7 ft. by 9 in. by 4½ in., were then laid 2 ft. 6 in. apart centre to centre, as shown in the drawing of the cross section (Fig. 5), the rails being attached thereto by spikes one on each side of the flange of the rail, additional spikes being used on curves. The track, after being truly levelled up, was filled to within two inches of the top with clean slag, the space left being boxed up to rail level with good clean engine ashes, in order to comply with the Board of Trade requirements. On one short length between Wheelwright Road and Bromford Lane slag was used instead of ashes. It is the intention, however, in the near future to grass the tramway area as has already been done on a short length of track laid down in Pebble Mill Road (and illustrated in Fig. 4). This was the first line constructed in Birmingham on the sleeper principle. The track crosses two public roads, and at these points the standard method of construction on concrete was adopted. To conform to the existing road surface, Plascom macadam has been laid down. There is one crossover road and one loop end on the route, the usual British Standard Section Rail, No. 4, being used, with standard pattern points and crossings supplied by Hadfield's, Limited, of Sheffield.

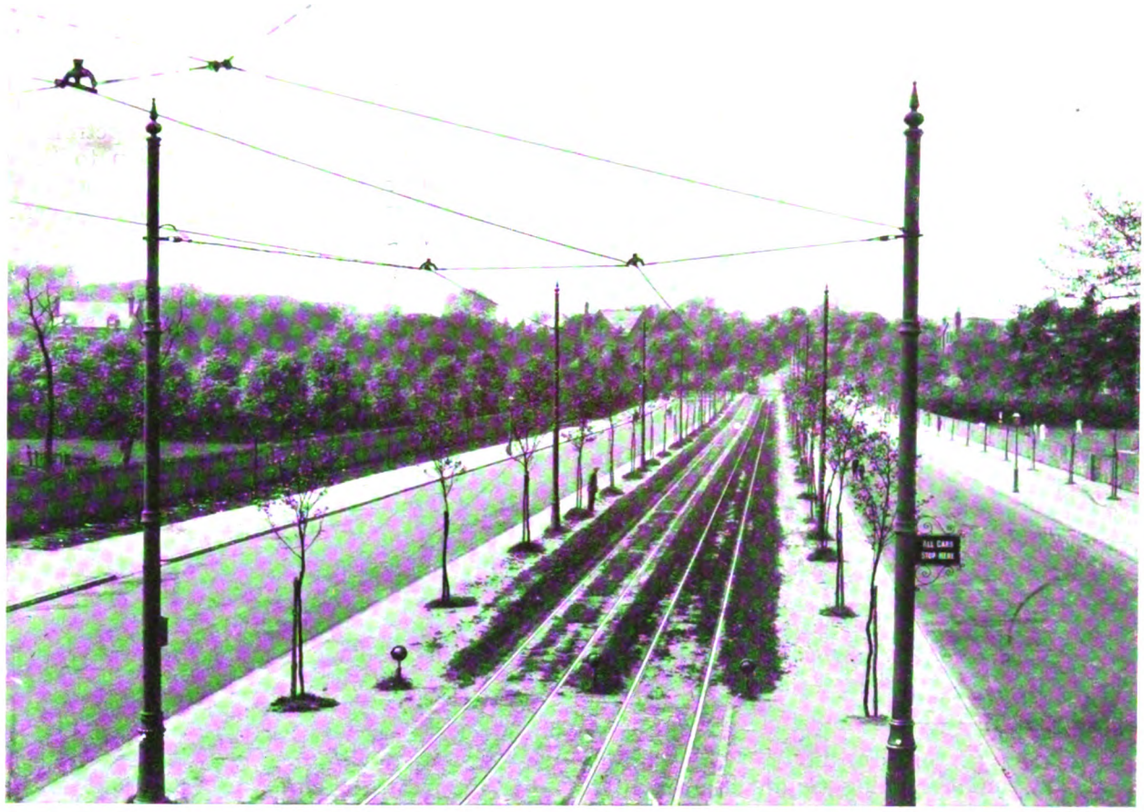

Fig. 4.—First Sleeper Track Line of Birmingham Tramways, in Pebble Mill Road, showing Grass-covered Surface.

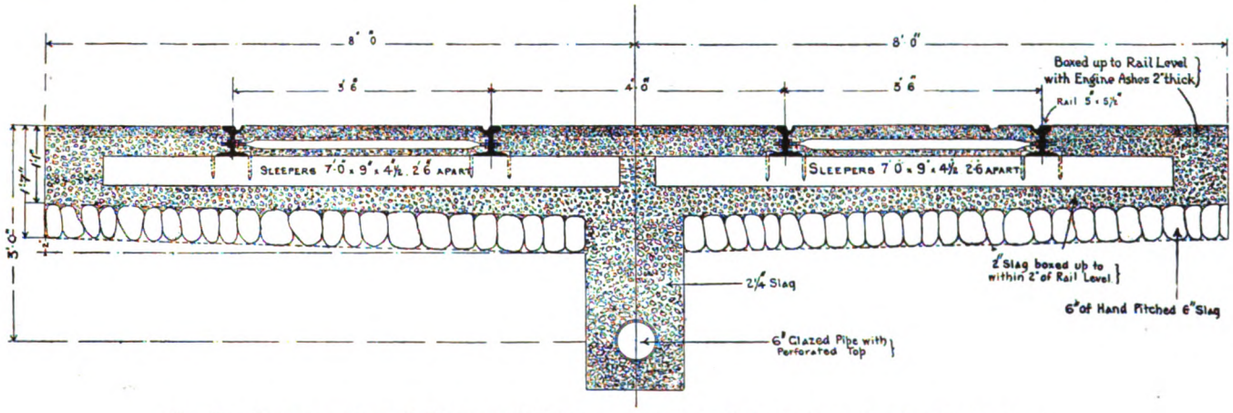

Fig. 5.—Cross-section of Sleepered Tramway Track Laid in Tyburn Road, Birmingham.

The overhead equipment was erected by the department's staff, and the majority of the fittings are of M.T.A. standard. The construction is of the side arm

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type, except at section insulators, where the suspension is by means of two parallel spans. Great difficulty was experienced in the erection of the poles owing to the varying nature of the foundation, some being planted in the solid rock, which had to be blasted away while at other places the foundation had to be built round them.

To anyone unacquainted with Birmingham it would

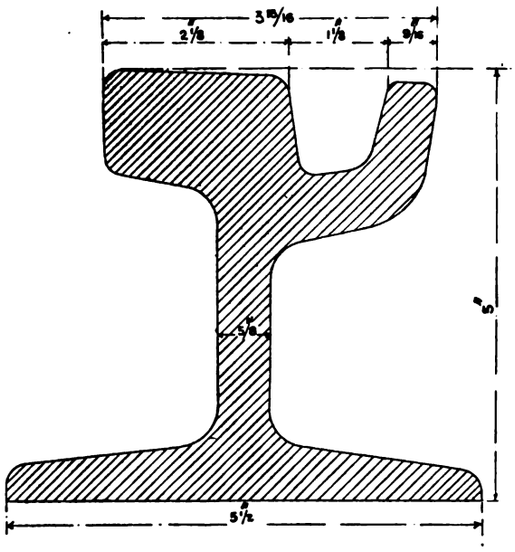

Fig. 6.—Section of Rail used on Birmingham Sleepered Track.

be difficult to realise that the route is within three miles of the centre of the city, the red sandstone cliff and general surroundings giving it quite a rural aspect. When the scheme is completed by the widening of the road for the entire distance, and the carriageways on

Fig. 7—Perforated Drain Pipe laid under clearway of Birmingham Sleepered Track.

each side of the track are formed, Birmingham will possess one of the finest sleepered tracks in the country, and as the land on each side of the tramway is rapidly being developed, there is little doubt that it will, in the near future, amply repay the outlay expended upon it.

A.E.C. RAILLESS TROLLEY OMNIBUS.

SINGLE MOTOR EQUIPMENT AND PATENTED CONTROL.

The production of a railless trolley omnibus by the Associated Equipment Company, Limited, of Walthamstow, is an event of peculiar interest, inasmuch as the building of such vehicles has hitherto been left for the most part to tramway engineers, or at any rate to those whose experience is rather of vehicles to run on rails than of those operated on common roads. The fact that the company who build the petrol omnibuses of London have now given attention to the electric trolley omnibus is testimony to the important position which this type of vehicle has assumed under present economic conditions.

Front and Side View of A.E.C. Railless Trolley Omnibus.

The A.E.C. chassis as a whole is the direct outcome of extensive experience in the operation of passenger-carrying road vehicles. One of the lessons of this experience has been that simplicity of mechanism is commonly of more importance than high theoretical efficiency, which often does not materialise in practice. This being so, the Associated Equipment Company, in selecting their electrical machinery, have not employed two motor equipments with series-parallel control and each having its own transmission to the back axle. Electrically this system is highly efficient, but from the standpoint of upkeep of a road vehicle, as well as of first cost, it is inferior. Consequently the system adopted in the example under consideration involves the use of a single electric motor with a purely rheostatic control. The electric motor is one of the latest examples of the ventilated commutating pole type of tramway motor, and is consequently capable of standing up to big overloads without trouble or breakdown on the commutator or elsewhere.

The electric motor is supplied by the British Thomson-Houston Company, and the arguments in favour of a single motor equipment of this type are—

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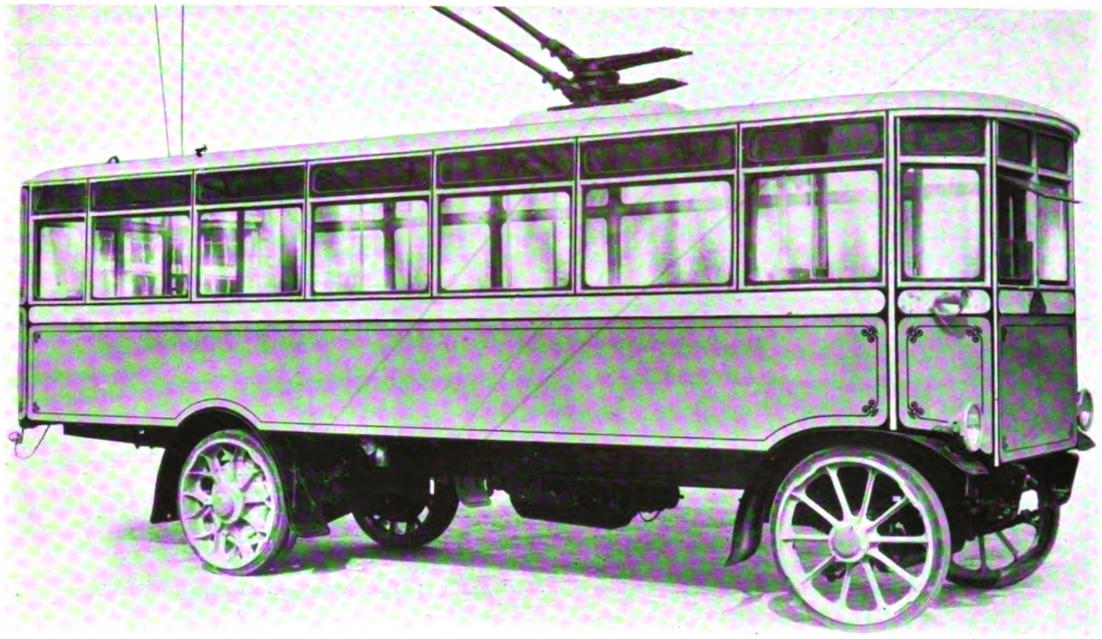
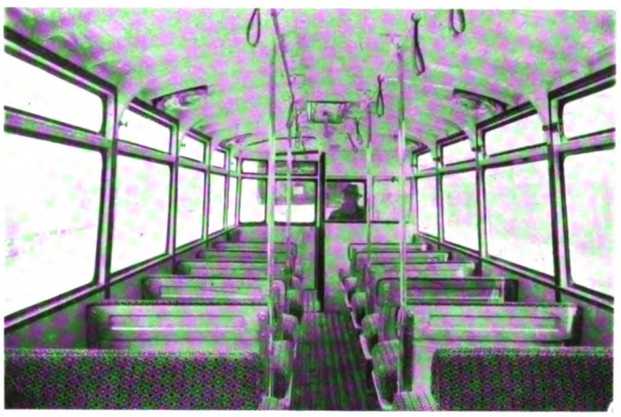
(*a*) Simplification of chassis.
(*b*) Lower maintenance charges.
(*c*) The higher efficiency of one motor and one worm gear as against two motors and two worm gears.
(*d*) Less running friction, and therefore greater ability to coast.
(*e*) With high acceleration and long coasting distance the economy compares well with series-parallel control systems.



Side View of A.E.C. Railless Trolley Omnibus showing Motorman's Screen Open.

The next special feature to call for attention is the system of control. This must be considered in two parts, both of which are covered by patents. The first part consists of a foot-operated drum controller, so designed that the forward motion accelerates the vehicle notch by notch on the controller. On releasing the foot the controller comes back to the off position by itself. It is prevented from going back into reverse position by an automatic locking lever.

In order to reverse, the locking lever has to be moved by hand. The reverse is operated by a heel pedal which is positively connected to the forward speed pedal. It will thus be obvious that either pedal can be returned from its driving to neutral position by foot pressure on the opposite pedal. This arrangement affords a safety device in the event of either return spring failing to operate. Looking at this from the standpoint of a driver accustomed to petrol vehicles, one may consider what are the necessary movements to operate the trolley omnibus compared with the petrol one. The driver of the latter has a gear change lever, a foot-operated clutch, and a foot accelerator; he also has a foot brake and a hand brake. Assuming the engine is running, to start the omnibus he has to depress his clutch pedal and insert his first gear; then release gently the clutch pedal and depress the accelerator pedal, and repeat this operation for each gear change until he is in top gear and can then drive on the accelerator. On the other hand, the trolley omnibus has no clutch or gear changing lever, and the driver merely depresses his foot control pedal gradually notch by notch until he arrives at the full-on position. This action is similar to the operating of the accelerator of the petrol omnibus.



Interior of A.E.C. Railless Trolley Omnibus.

The steering and the foot and hand brakes are exactly similar to the petrol omnibus. The reverse is operated by the pressure of the heel on an extension of the controller pedal after first unlocking it by means of a hand lever; this locking arrangement has its counterpart in the petrol omnibus gate change safety locking device for the reverse gear.

The second part of the control is entirely automatic, and its purpose is to increase automatically the power of speed acceleration of the vehicle. At the end of the motor shaft a governor is mounted which operates a switch only when the critical speed at which acceleration would normally fall off is reached. The switch, by means of a contactor, introduces a shunt resistance across the motor field winding. The effect is to increase the acceleration, with the practical result,

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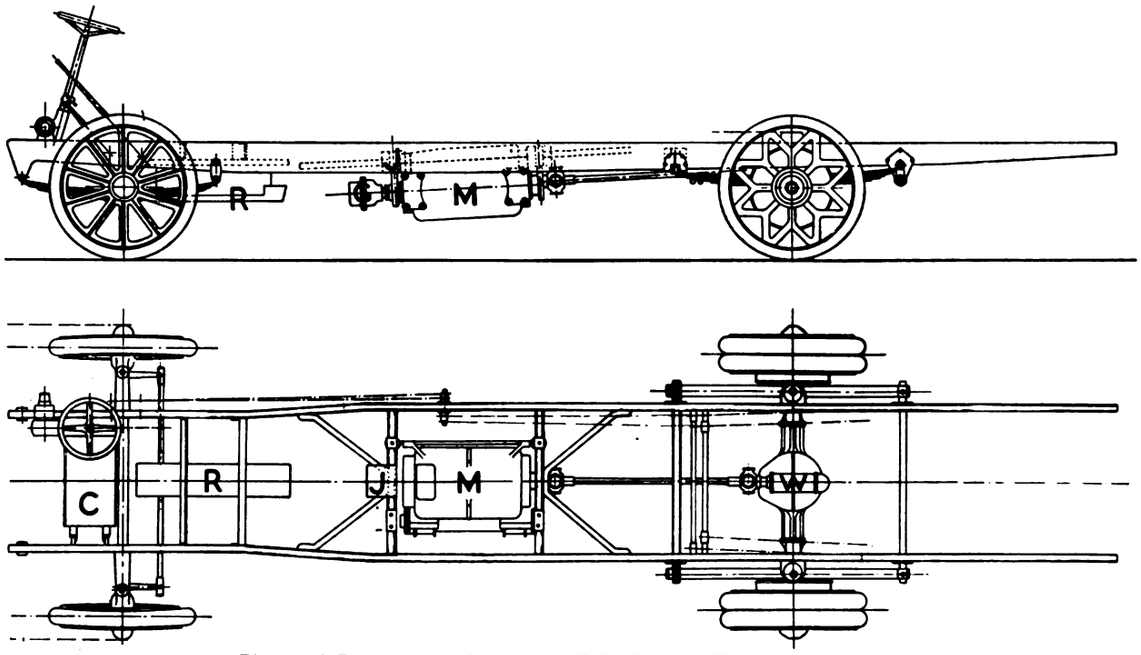
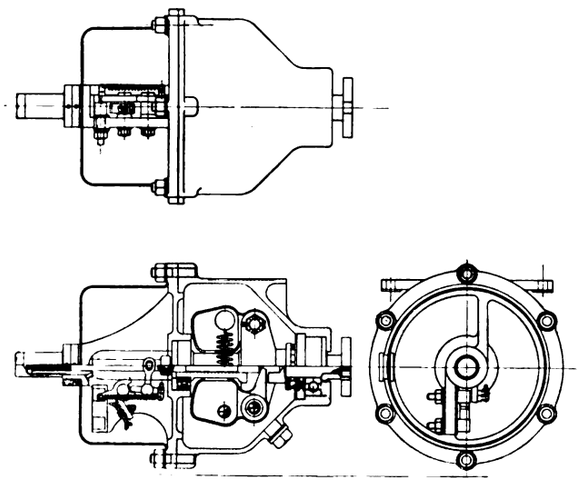
proved by extensive tests, of something like a 10 per cent. improvement in average speed during a normal run with stops for taking up and setting down passengers. It will be seen that the governor is used, not as in a petrol vehicle for limiting the engine speed and through it the vehicle speed, but, on the other hand, for enabling the motor to rotate more rapidly when conditions are such as to render this safe and desirable. When a shunt resistance is operated by this method there is no interference with the ability of the motor to exert its full torque at any speed below the critical speed. The effect of the automatic device is to give good acceleration under suitable circumstances, but to prevent the overloading of the motor by any attempt to accelerate too rapidly on a steep grade. Supposing that the introduction of the shunt resistance were left to the discretion of the driver instead of being automatic, a mistake on his part would involve a risk of burning out the windings. As it is no such risk exists.



Plan and Elevation of Chassis, A.E.C. Railless Trolley Omnibus

Reference: C—Controller; R—Resistance; J—Junction Box; G—Governor; M—Motor; W—Worm Gear to the Differential.



Arrangement of Auto-Governor Switch.

For the rest, the main features are as follows. The motor, which is rated at 33·5 B.H.P., is spring suspended in the chassis. The rheostat is of the unbreakable grid type, and is spring supported. It is fixed to the chassis in the position shown in the accompanying photograph, and is protected from mud and rain by a suitable tray and cover, so arranged as not to interfere with the ventilation. The wiring between the controller and the rheostat is effected by the use of high grade rubber-insulated and braided cables, heavily taped together and supported on the chassis by hard wood blocks. The two trolley booms swing from a common centre, and are mounted on a ball-bearing base. They are balanced by heavy external springs, which are adjustable to give the necessary contact pressure on the trolley wires.

Turning to the ordinary features of the motor chassis, the frame is of the flitch type, built up of ash, with nickel steel flitch plates. The steering gear is of the worm and nut type. The front axle is an I section stamping, and the rear axle is worm driven and of the standard design used in the heavy A.E.C. lorry chassis. Both foot and hand brakes operate on drums directly attached to the rear wheels. Very long and wide flexible road springs are fitted. The weight of the chassis is three tons five hundredweights, and the unladen weight of the complete vehicle, with a 36-seat single-deck body, is about four tons eighteen hundredweights.

The appearance of the vehicle, external and internal, is depicted in the accompanying photographs, while the plan and elevation drawings show the positions of the main components—namely, the controller C, the resistance R, the junction box J, the governor G, the motor M, and the worm gear to the differential W.

Proposed Railless System at Twickenham.—The London United Tramways have informed Twickenham District Council that it is not their intention to reconstruct this year the portion of the track between Twickenham Junction and Richmond Bridge, but rather to consider the question of seeking authority to discontinue the tramways on that section, and run in place thereof railless trolley cars. After the recent Tramway Congress at Bournemouth, the double-deck front drive railless car there demonstrated was brought to Twickenham, and was inspected by officers of the tramways associated with the London Underground group.

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OPERATION WITH TROLLEY WHEELS AND TROLLEY SHOES COMPARED.

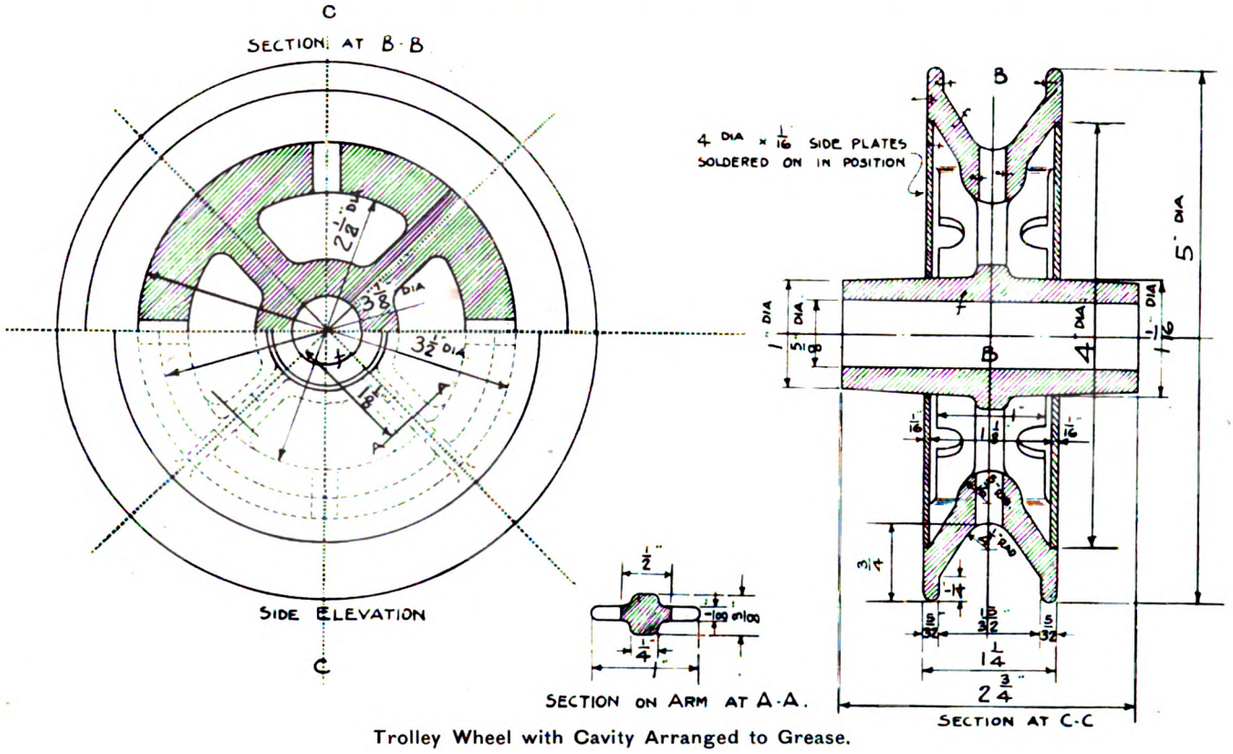
After experimenting for many years with various types of trolley shoes in place of wheels, Mr. R. H. Wilkinson, general manager of Bradford Corporation Tramways, has designed and patented a trolley head with shoe which complies with all the conditions considered essential to successful operation. The head comprises a socket fitting on the end of the trolley boom, a centre swivel, compound link and shoe. The overall width is in no part greater than the width of the socket, and the arrangement of links and shoe is such that in the event of the shoe being de-wired and coming into contact with span wires or overhead fittings, the shoe is pushed forward, and by means of the links is enabled to fall clear of overhead obstructions, thus producing a form of trolley which is practically non-fouling.

In order thoroughly to test this device, and to ascertain the comparative wear of overhead wires by trolley shoes and trolley wheels, the cars on a tramway route were fitted with trolley shoes, and cars on a similar route with trolley wheels, careful measurements and observations being taken from time to time of the condition and wear of the trolley wire and shoes. The portions of the routes upon which the tests were taken had similar gradients. Full details of the gradients and results of the tests are set out on the accompanying table. From this it will be noted that the measurements taken, extending from November 2, 1919, to November 26, 1920, showed that with shoes the up wire had been reduced in diameter by ·0181 in., and the down wire by ·0135 in., with a total number of cars passing over this route of 33,428, whilst on the section upon which trolley wheels were installed the wear upon the up wire was ·0050 in., and of the down wire ·0052 in., with 37,615 cars passing over the route, demonstrating that during this period a greater wear of the trolley wire was occasioned by the shoes than by the trolley wheels.

Examination of the running surfaces of the wires during this period showed that the wire over which the shoes were running had a perfectly clean and burnished surface, whilst that over which trolley wheels were running was of a dull, frosted appearance, showing marks of arcing over the whole of its surface. Up to this date there was no sign of seizing whatever between the shoes and the wire. During the hot weather of 1921 the shoes on the trolley wire of the original test route showed signs of seizing. Lubrication was resorted to, with an immediate relief from seizing.

Further measurements of the trolley wires of the two sections before referred to were taken on February 14, 1922, and showed that the up wire over which shoes were running had worn in diameter ·0041 in., and the down wire had been reduced in diameter by ·0021 in., the total number of passing cars being 30,828. The comparison test on the route upon which trolley wheels were being run showed on the up wire a wear of ·0050 in., and on the down wire a wear of ·0029 in., the total number of passing cars being 34,261, thus indicating that lubrication of the wires upon which shoes are being used had reduced the wear to less than that occasioned by trolley wheels.

Whilst these tests were proceeding, a further tramway route with 14 service cars was equipped with shoes in lieu of trolley wheels. On this route seizing between the wire and shoe very early manifested itself, and became so serious that shoes were pulled over due to seizing with the trolley wire. In order to overcome this arrangements were made for lubricating the trolley wires with graphite grease. Seizing of the shoes immediately ceased, and the wire developed a highly polished running surface, the grease being applied to the overhead by means of a trolley wheel with a cavity arranged to hold a quantity of grease, and holes in its



Trolley Wheel with Cavity Arranged to Grease.

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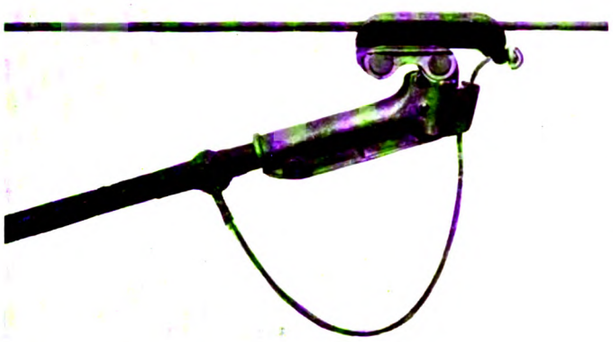
periphery through which the grease is forced out on to the wire by centrifugal force. One car on each route is fitted with this wheel, which is filled with grease once each day.

On the Bowling Old Lane section trolley wheels had been used for many years prior to the change over for shoes. The overhead line is 0000 round section, and fitted with clinched ears. Prior to fitting trolley shoes, hollow places had been hammered in the wire by the trolley wheels at the leaving end of the fittings.



Trolley Shoe running on Wire.

Examination after the shoes had been running for some months showed that the shoes were sliding over the hollow portions. This in itself should prove to be of very great gain, as in place of accentuating the weak spot at the end of the fittings, the shoes, by their sliding-over movement, are preventing further similar damage, and causing wear to take place evenly over the whole surface of the wire, instead of reducing the diameter of the wire at the leaving end of fittings.

Trolley Shoe De-wired and Pushed Forward into Non-fouling Position.

This latter process, in addition to shortening the life of the wire, brings about conditions conducive to breakages and consequent interruption in the tramcar service.

The life of the shoes appears to be determined largely by weather conditions. During the ordinary atmospheric conditions experienced in the Bradford district the life of the shoes appears to be at the rate of about 10,000 miles per shoe, but during rainy weather the wear of the shoe is much more rapid, while in frosty, snowy and sleety weather the shoes wear or burn away very rapidly, and in some cases will not average more than 1,500 miles. Since June 22, 1921, the Bowling Old Lane wires have received constant application of graphite grease through the medium of a distributing trolley wheel. These sections of tramway route were laid down about the same period, and have a very similar loading of cars.

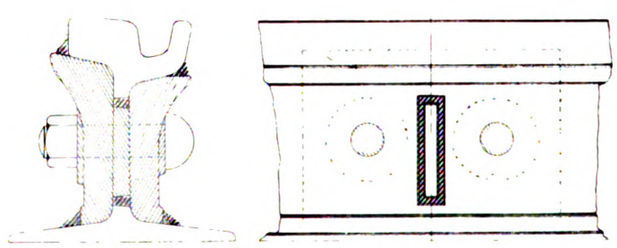
No overhead fittings have been changed, owing to damage occasioned by the use of trolley shoes, but the use of shoes is occasioning heavy wear on the wire of trolley reversers and other places in the overhead having short radius curves.

Comparison of Wear of Trolley Wire with Trolley Shoes and Trolley Wheels.

	Trolley Shoes.	Trolley Wheels.
	Bowling Old Lane Section.	Heaton Section.
Gradient (average)	1 in 12	1 in 13
Diameter of trolley wire when new ...	0·4 in.	0·4 in.
First test, Nov. 2, 1919, *to Nov.* 26, 1920.		
Reduction due to wear of up wire ...	0·0181 in.	0·0050 in.
Reduction due to wear of down wire	0·0135 in.	0·0052 in.
Number of trolleys passed over wire in this period	33,428	37,615
Second test, Feb. 22, 1921, *to Feb.* 14, 1922.		
Reduction due to wear of up wire ...	0·0041 in.	0·0050 in.
Reduction due to wear of down wire	0·0021 in.	0·0029 in.
Number of trolleys passed over wire in this period	30,828	34,261

RAIL JOINT WELDING.

A good deal of reconstruction, repair, and maintenance work is at present being carried out by the Corporation of Bury in connection with the tramways permanent way, and several new and interesting



End and Side Elevation of Welded Rail Joint.

devices are being introduced. All rail joints are being electrically welded on the electric arc system, and a special type of welding plate is being used. In connection with new work the welding plates in use are made in mild steel eight inches in length, and so designed as to give a maximum amount of welding area to the rail joint. Along the entire length of the plate a trough or ledge is provided which protrudes three-quarters of an inch beyond the outer edge of the tread and check of the rail. This ledge exposes an area of 2·25 cubic inches for welding on either side of the rail head, and concentrated 4 inches on each side of the joint.

A novel feature in the design is the spigot, ⅜ in. in width, which forms a solid part of the head side plate. This spigot passes equally through the webs of the rail and level with the web on the check side of

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rail. The recess is cut 3-16 of an inch larger than the spigot by oxygen, hydrogen, or other gases to form a V for welding the web, and so reinforces the web of the rail by making the welding plates and web in one solid mass. This obviates all vibration through the head of rail caused by fast moving traffic. The

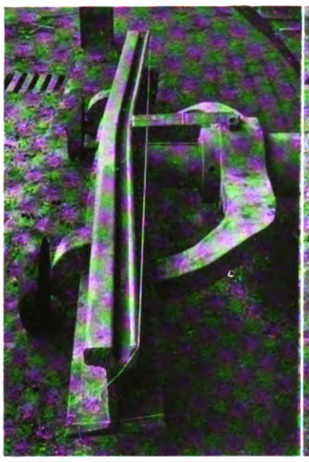

Fig. 1.—Joint Weld complete on an 8 ft. rail under test. Fig. 2—A continuance of test shown in Fig. 1.

welding plates are machined to suit all sections of rails, and form a perfect fit, flush with the web of rail.

Several advantages are claimed as a result of the use of these special plates. The protruding ledge or trough along the top of the plate exposes a large area

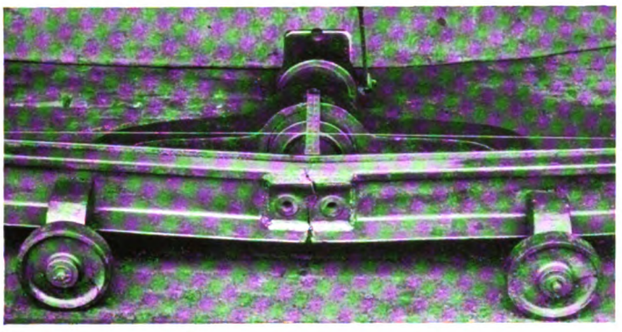

Fig. 3.—Side View of effect shown in Fig 2.

of plate and rail head for welding, and the design avoids overhead welding, which is often unsatisfactory and costly. Moreover, perfect supervision over the welding work is provided for, as all the welding can be seen at a glance. The plates lend greater support to the head of the rail, and being flush to the web of the rail there is no vibration; 9·5 cubic inches of welding is concentrated actually on the joint. The provision of these plates has resulted in a very effective reduction in cost per joint, and the output per welder has been very considerably increased.

Some extremely interesting experiments have been carried out, and Fig. 1 shows a joint welded complete on a rail 8 feet long. This was subject to a 40 ton hydraulic crow test, and no sign of fracture was found and the welding undisturbed. The middle ordinate was $1\frac{7}{8}$ inches. Fig. 2 shows a continuance of Fig. 1 test with middle ordinate $3\frac{1}{4}$ inches. Both welding plates were broken, and also the rail one inch away from joint. The welding under this test was not disturbed. Fig. 3 shows a side view of the result of this test. Fig. 4 shows a welded joint on another short rail with *one* plate only welded on the tread side. This joint was also subjected to a 40 ton hydraulic test, and the middle ordinate was $1\frac{7}{8}$ inches when broken. No welding was disturbed. Fig. 5 shows a joint with one plate welded on the tread side, and on this being subjected to a 40 ton test the rail broke through the head and web. The welding was disturbed in the web—left-hand rail. The middle ordinate was $1\frac{7}{8}$ inches.

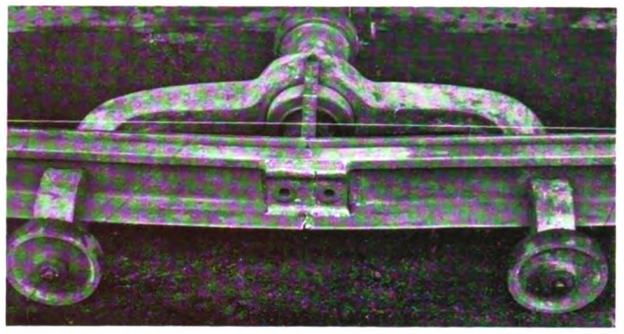

Fig. 4.—Welded joint on another short rail with one plate only—welded on the tread side.

The Corporation are also using a modified reinforced welding plate, which is attachable to ordinary 6-hole fishplates. Over 1,000 pairs of these welding plates have been used with great success, there being no sign of fracture in any of the reinforced joints. Both types of special plates have been designed and patented by the tramways permanent way engineer (Mr. S. Butler), acting in collaboration with the general

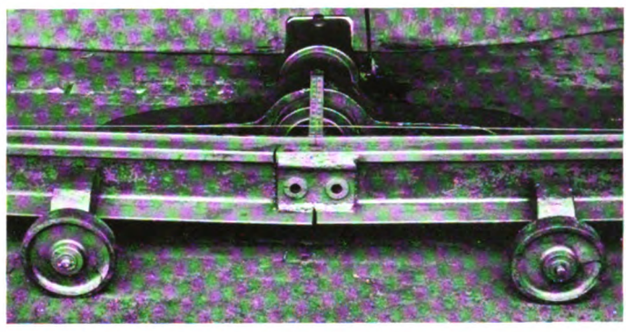

Fig. 5—Joint with one plate welded on tread side.

manager (Mr. Frank Buckley), to whom we are indebted for these particulars.

ELECTRIC RAILWAY FOR MILAN.

A meeting recently took place in Milan of engineers and architects to hear a report by the engineer, Achille Bassetti, on the project for the construction of a metropolitan railway in that city. The scheme drawn up by the technical office of the municipality provides for the construction of two lines almost entirely underground, one traversing the area involved from the Piazzale Loreto to the Maddalena, measuring 7·4 kilometres, which is to be completed in three years, and a circuit railway of 13·5 kilometres to be completed in five years. The engineer said that for safety purposes the electro-automatic block system would be adopted for the trains. The rolling stock would consist of steel carriages larger than those now in use, namely, 2·60 metres wide, 3·40 metres high, and 14 metres long. Four motors of 90 H.P. would be installed. The trains would attain a maximum speed of 40 kilometres per hour, and a commercial speed of 20 to 25 kilometres per hour. The current preferred is the direct rather than the one-phase or three-phase. The pressure will be 600 volts, and the rails will be rather heavy—52 kilogrammes per running metre (minimum), with a third rail for return current.

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THE
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THE EDITOR will be glad to consider articles by experts. All information of a practical character relating particularly to the engineering and operating branches of transportation will receive prompt attention. Original illustrations will also be welcome.

LONDON, JULY 13, 1922.

London Tramways Finances.

Considering the trade depression and the further loss of employment due to widespread strikes, the financial result of the working of the London County Council Tramways for the year ended March 31 last may be deemed very satisfactory. After meeting all charges, including interest and sinking fund, the accounts show a deficiency of £88,757, and it is safe to say that if there had been no omnibus competition there would have been no deficit. The County Council have never yet adopted what would probably be an effective and legitimate way to counter the competition. We refer to the use of publicity in order to lead Londoners to recognise that the tramways are the property of the ratepayers. The lack of civic patriotism is notorious among citizens of the metropolis, and owing to the scanty notice which the affairs of the County Council receive in the newspapers, very few ratepayers are aware that for three years a deficit on the tramways has had to be met from the rates. Another point which is deserving of attention is the desirability of increasing the speed of the cars. It is not conducive to popularity for the cars to be left in the rear by the omnibuses, particularly on sections where the speed limit for the cars is 16 miles per hour, while that of the omnibus is only 12 miles per hour. In view of the depression and increased competition it is not surprising that the number of passengers carried was 1,300,000 less than in the preceding year. Thanks to increased fares the receipts were higher by £300,000, although during part of the year the fare unit was reduced from three-halfpence to a penny. The route length increased by twelve miles, and the number of car-miles run was greater by two millions. The most satisfactory items in the accounts are that the higher revenue was secured on a decrease of about £230,000 in the working expenses, and that the surplus on working was £773,429, as against £280,773 for the previous year. Bearing in mind that further reductions in the cost of living will entail decreases in the wages of the employees, and that the prices of materials continue to fall, the surplus on working should continue to expand. A very gratifying feature is that nearly £7,000,000 has been repaid of the £15,616,000 expended on capital account. Although London's tramways have never been able to vie with the great provincial centres in producing substantial sums in aid of the rates, the Council's undertaking annually hands over to the borough councils large amounts in respect of rates on tracks, and pays a large proportion of debt charges on street improvements, besides saving the borough authorities some £271,000 a year on the maintenance of road paving. For the past year these payments reached a total of approximately £379,000. It is far too soon yet to listen to appeals to bring fares down to the low level of pre-war years. The Highways Committee as a whole appreciate that danger, for their chairman met the suggested concessions by the statement that none could be entertained until the deficiency has been turned into a surplus.

The Rule of the Pavement.

To change a fixed habit or to create a new one, however small or comparatively trivial, is admittedly a difficult task. In the case of the campaign to alter the rule of the footpath to "keep to the left," which was officially inaugurated in London on July 1, the London

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Safety First Council have set themselves a problem that will require all their energy and ingenuity. The movement has been fortunate in receiving a large measure of favourable publicity in the press; the great majority of the metropolitan boroughs and most of the local authorities in the environs have expressed their approval, and we believe that it is only a matter of time before the public generally will conform to the new rule. That the measure of response to the many printed injunctions to "keep to the left" which met the pedestrian at every turn on July 1 was not conspicuously large is of little significance. The old habit of walking on the right and the equally common habit of walking anywhere and everywhere are not to be changed on a single Saturday morning or even in a month. There is reason to believe that until the first of this month many folks had barely heard of any rule of the pavement, and were a trifle puzzled by the ubiquitous notices. But the knowledge that we were being asked to mend our ways soon began to pervade the streets, and caused people to "cross over" and march with the times. It is only by continual and insistent publicity that the desired change will be completely effected. That it will, indeed, ultimately supersede the older rule there is little doubt; for the innovation has common sense behind it, while its predecessor had but little in its favour. The reasons which prompted the change to the left-hand rule have been fully stated from time to time in these columns, and we have yet to hear of any argument against it which outweighs the consideration that to walk on the left is to face the oncoming road traffic. While the City of London police authorities naturally speak with great experience on all street traffic matters, it is difficult to understand their opposition to a change which is favoured in practically every other part of London and such provincial centres as Birmingham, Glasgow, Halifax, Nottingham, and Bristol. Dr. Waldo, the City and Southwark coroner, is reported to have said that the new rule was certainly plausible, but would not carry conviction on inquiry. In practical support of such a theory, he was unable to recall a single instance in his experience during the past twenty-one years in which anyone had met their death through walking on the right side of the footway. This is but a negative form of reasoning, and does not account for the people who have either been injured or who have experienced narrow escapes through absent-mindedly stepping off the footwalk in the track of a vehicle approaching from behind. The greater the measure of safety which can be accorded pedestrians—who, after all, are prospective passengers—especially at such points as tramcar stopping places, the better it will be for all concerned. Tramway undertakings have therefore an interest in the matter, and would be well advised to accord the movement every encouragement and support.

At the Bournemouth Congress.

Merely to recount the outstanding points in the papers and the discussions at the Bournemouth Congress of the Tramways and Light Railways Association would fill several pages, and still leave sufficient matter to make detailed perusal of the reports profitable. Mr. Bulfin's testimony to the value of the sorbitic treatment of rails *in situ* received sufficient corroboration to merit further scrutiny elsewhere. That there is no stagnation in railless trolley car construction and equipment was proved by Mr. Munro's paper and the comments thereon. Not the least important sign of railless car progress is the substitution of foot control for hand operation of the controller, the latter course necessitating the driver taking a hand off the steering wheel. The merits of railless traction in certain circumstances received general endorsement; and not the least valuable testimony was given by Mr. Spencer as the result of visits which he has lately paid to tramway undertakings in England and Scotland. Among men who have had experience of tramcars, railless cars and petrol omnibuses, he found the general opinion to be that on a reasonably short headway the railless is operated at about 60 per cent. of the cost of the motor omnibus. Mr. Spencer maintained that tramcars of to-day are, with the exception of minor details, almost exactly of the same type as those manufactured twenty to twenty-five years ago, but his dissertation on "modern improvements in rolling stock" evoked a discussion that revealed several exceptions to his contention. One notable advance is the provision of ball bearings to axles, a

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matter in which further progress may be anticipated. As Mr. Chivers remarked, the paper comes at an opportune time, for on many undertakings the rolling stock has got near the end of its useful life. This consideration lends importance to the suggestion made by Mr. R. J. Howley that Mr. Spencer's paper points to the necessity of the two Tramways Associations working in co-operation to set up engineering committees to investigate the various points.

Staircases and Seats. Evidence of considerable progress in the design of car bodies was given by Mr. R. Humphries in pointing to the front end exit car with vestibule fronts which has lately been introduced on the Wolverhampton and Swansea undertakings. Indeed, some forty cars of this type are run by companies with which Mr. Humphries is connected. There is another direction in which car bodies might be improved, and that is by the provision of interior staircases combined with the front exit. Mr. Hatton has shown at Newcastle how beneficial results accrue from that departure, while in the United States similar benefits have been achieved on heavy traffic lines with cars having a central entrance and exit and an inside staircase to the upper deck. It is of interest to note that the bodies of the double-deck railless cars with front drive now in operation at Leeds are designed on similar lines. The adoption of an interior staircase is rendered more necessary now that the Ministry of Transport, following the misguided action of the public carriage department at Scotland Yard, has decided against end staircases facing inwards. Stairs have now to face the near side of the road, the reason given for this decision being that the reversed position is alleged to interfere with the off-side view of the motorman. A decade ago the London County Council was put to great expense to make this alteration, with the result that on the Embankment a few years ago a fatality occurred owing to a passenger falling over the staircase railings. One suggestion put forward at Bournemouth is capable of being adopted by any undertaking on the initiative of the manager. It is the provision of spring seats which has been advocated in these columns. Where there is competition with omnibuses this course is especially advisable.

STANDARDISATION.

By Arthur Norton, A.M.I.C.E.

In contributing to the discussion on Mr. Spencer's paper which he read at the recent Tramways and Light Railways Conference at Bournemouth, I intended to have made reference to the admirable article on this subject that appeared in the issue of The Tramway and Railway World of February 11, 1922. Whilst that article very ably set forth the advantages and value of standardisation, perhaps I may be permitted to cross its t's and dot the i's, in the hope that it may help to stimulate the interest and support of managers and others who are interested in the design of new cars. After all, it is only by the help and co-operation of the managers, etc., that the efforts of all those gentlemen who were responsible for the drafting of the various specifications will bear fruit, especially when it is considered that the time and labour of these gentlemen is given voluntarily for the benefit of all concerned.

So far as standardisation of the modern tramway car is concerned, it is perhaps unfortunate that there is not some central authority, such as might be compared with the Railway Clearing House. That body many years ago decided to standardise wagon rolling stock. Their action created an enormous amount of opposition, especially on the part of private owners, which was eventually overcome, but a number of years had to elapse before standardisation became an accomplished fact. The beneficial effects that have followed the adoption of the standard wagon are seen in increased production and lower costs, these advantages being shared by both user and manufacturer.

In the tramcar industry of the country, however, every corporation and company are more or less a law unto themselves. As a consequence it is always easy for an authority to show a good reason why it should not adopt a standard, but in the present state of affairs, assuming that standardisation is desirable from a national standpoint, it behoves the user to take the long view, and assist standardisation wherever possible.

Mr. Edwards, of the Hastings Tramways, in replying to some remarks I had made during the discussion on Mr. Spencer's paper at Bournemouth, when I stated that since the issue of the British Engineering standards specifications for tyres and wheel centres my firm had not received a single inquiry for standard sized tyres, expressed a certain amount of gratification at that result, as he was of the opinion that the size of the tyres as fixed by the Standards Committee was too small. If that is so, does it not show a need for some central authority to standardise the various types of trucks, so that in the future some kind of uniformity may be arrived at? Unless this is done there is a very great danger that we shall carry on in the future as we have in the past, for as the editor of this paper, in the article above referred to, remarked, "to deviate from a standard is largely to lose the value of it." It may not be possible to do anything with existing stock, but wherever new stock is being ordered, the standards should be adopted, unless prevented by some very valid reason.

New L. & N.W. Suburban Train Service—The commencement on July 10 of a new electric train service on the L. & N.W. Railway between Watford Junction and the termini at Euston and Broad Street, marks the completion of a large electrification scheme. Trains now stop at Chalk Farm, South Hampstead (previously named Loudoun Road) and Kilburn Stations, which were closed during the war. (The rolling stock was described in our issue of June 15 1922).

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Tramways and Light Railways Association

Fourteenth Annual Congress held at Bournemouth June 22 and 23, 1922.

The fourteenth annual congress of the Tramways and Light Railways Association was held at Bournemouth on June 22 and 23. The members and guests, including many ladies, were welcomed at the Town Hall at 10.30 on Thursday morning by the Mayor of Bournemouth (Alderman C. H. Cartwright, J.P.).

The Mayor said—Ladies and gentlemen, it is with the greatest pleasure as Mayor of this borough and representative of the Civic Council of this town that I accord to you a very hearty welcome upon your visit here. This visit, so far as you are concerned, is somewhat memorable, because, although it is the twenty-fifth year of your Association, I understand that this is the first Congress you have held out of London since the war. We in Bournemouth therefore esteem it a great honour as well as a great pleasure that you should have selected our beautiful town as your meeting place. We are delighted to see you, and that for more than one reason. You represent the tramway systems in which we as a municipality are also deeply interested. We welcome you, not only because you represent that great and important industry, but because we feel sure that your visit will give you an opportunity of studying the town of which I, as Mayor, am exceptionally proud. We in Bournemouth claim that our town, as a seaside and health resort, is essentially a progressive town—a town which is not only progressive in the advantages it holds out for those who come to stay with us, but because we are truly at every point a self-governing town. We have the good fortune to hold nearly all those services which administer to the good of the public. We not only own this excellent tramway system, which we think provides a model tramway service, but also the piers, the links, and other properties which administer to the enjoyment, and, I trust, the well-being of the town of Bournemouth. I am proud to say that every one of these ventures has turned out successfully from the financial point of view. We in Bournemouth are exceedingly proud of our tramway service. It has been brought to a very high pitch of perfection under the able management of our general manager, Mr. Bulfin. Although it may not be so rapid in transit as some other systems, owing to the peculiar formation of our town in the centre, yet I think that when you have travelled upon it and seen it in all its ramifications, you will agree with me that as a tramway service it is luxurious and easy-riding. I hope that during your stay you will see all those points in Bournemouth of which we are proud, and that you will go away with the firm resolve to come and spend many more days in future amongst us. In the name of the town, of the civic authority, and of the citizens of Bournemouth, I accord you a hearty welcome.

Mr. C. G. Tegetmeier (Chairman of Council)—I have only to say how much we appreciate the kind welcome the Mayor has expressed to us, and how much we anticipate holding this conference in Bournemouth.

The members then proceeded to the Council Chamber, and Mr. C. G. Tegetmeier (chairman of the Council), who presided, called upon Mr. I. Bulfin, general manager, to introduce his paper on Bournemouth Corporation Tramways.

BOURNEMOUTH CORPORATION TRAMWAYS.

Contact of Wheel and Rail—Corrugation—Sorbitic Treatment of Rails—Cost of Road Maintenance.

In addition to the paper, the full text of which was given in The Tramway and Railway World of June 15, Mr. Bulfin gave some further explanations. He said—We have British standard specification for rails with grade on head of 1 in 21. We have British standard specification section of wheel tyres with a grade of 1 in 21. We lay our tram rail to the British standard specification. We buy our tyres to the British standard specification. We shrink the tyres on wheel centres, place them under the rolling stock, and everything runs happily. That is all very well, but after about five years we find that when the wheels come in for re-turning, instead of having a grade of 1 in 21, they have altered to 1 in 14 or 1 in 15, and in a further five years' time it will be found that this has increased to as high as 1 in 9.

In reconstruction and re-laying we cannot re-lay the whole of the line at the same time, and we have to take portions of the line as most convenient and re-lay it. What is the result? We have our rolling stock with a grade of 1 in 9 running on permanent way with a gradient of 1 in 21. The result is we only get point contact between the wheel and the rail, and under these conditions it will be found that the elastic limit of the steel has been exceeded, and with the constant grip and slip taking place, the whole of the new tramway becomes heavily corrugated within a week's time. These corrugations differ considerably from the standard corrugations. It is a fine ripple effect right on the running edge or gauge line of the rail. It will be found that on account of the weight of the car having only point contact on the rail, that the gauge line of the rail suffers this heavy corrugation, and in fact this edge of the rail becomes burred over into the lip. These corrugations are ground out with the result that, the rolling stock passing over the ground rail, we find we obtain short line contact in place of point contact, and the time for the reappearance of the corrugation becomes very much longer. This second set of corrugations, on being ground out, gives longer line contact between the wheel and the rail, and each time of grinding has the effect of taking longer for the reformation of the corrugation.

In regard to the "Sorbitic" treatment, the oxy-acetylene flame is applied to the head of the rail, and when the critical temperature has been reached, the rail is quenched. This has the effect of changing the ordinary structure of the rail into "Sorbite," while the running head of the rail is turned into "Martinsite" to the depth of about ¼ in. This hardening of the rail does not take place across the whole head, but is only applied for about the distance of 1½ in. from the running edge of the rail, and it is this portion of the rail that has to stand the heaviest wear. This change of the ordinary steel of the rail into "Sorbite" and "Martinsite" has the effect that the elastic limit of the steel is not exceeded, and although the continual grip and slip still take place, the hardness of the rail is able to withstand the corrugation effect.

I do not believe in the treatment of the rails sorbitically at the works, because I am of the opinion that the rails should first be laid, when they should wear to proper profile under work, and when that profile has been attained, then the sorbitic treatment "*in situ*" should be applied. In that way the form of the rail which is best is stabilised. The Sorbitic treatment *in situ* is applied from the running edge for the distance of 1½ in. across the head of the rail, and this extreme hardness prevents cases of wear on that portion of the rail, and rails will maintain their proper profile.

We have in Bournemouth treated some six or seven miles of rails by the Sorbitic *in situ* process. These portions of the line were very heavily corrugated, and grinding out had to take place constantly. On the last grinding out, some six years ago, the Sorbitic treatment *in situ* was applied, and since then the rails have not required to be touched in any way. I think that if you have seen the results of this treatment you will have no doubt as to its efficiency in preventing corrugation.

I should just like, with the consent of the chairman, to read a paragraph from my last annual report of the Bournemouth Corporation Tramways—

> Before laying the details before you, I should like to emphasise very strongly the fact that during the twenty years the tramways have been running not only have they never received a single halfpenny in aid from the rates but they have on several occasions made large contributions direct to the rates, and indirectly, owing to the obligations imposed by the Parliamentary Tramways Acts on all authorities running trams, they contribute yearly large amounts to lower the rates. This large contribution, namely, road making and maintenance, is one that has, is, and will be a serious point for discussion and dissension with all tramways authorities, more especially company undertakings. The Tramways Acts impose on all tramways concerns the obligation of making and maintaining all roads on which they run within the tramway area; all other users of the roads make use of these portions of the roads without any contribution, very often the other users being in competition with the tramways. In the case of Bournemouth, the cost to the tramways for road making alone under the present reconstruction scheme

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is over £80,000, and on the whole system within the borough over £120,000. The capital charges on this amount are a yearly payment of over £15,000, and if the tramways did not exist this amount would have to be found by the Roads Committee, and become a 4½d. charge upon the rates. The Bournemouth Corporation Tramways are the second largest ratepayers in the town, the annual amount paid in rates being over £5,000, equal to a 1½d. charge on the rates, so that the mere existence of the tramways in the borough, without taking into account the facilities they afford for intercommunication to all parts of the borough, means the lowering of the local rates by some 6d. in the £.

It will be noticed that the capital charges in Bournemouth per car-mile are exceedingly heavy, namely, 9d. per car-mile, and I think probably it may be of interest to the members to know how this amount is made up. Permanent way construction and road maintenance are responsible for between 4d. and 5d.; rolling stock is responsible for between 2d. and 3d.; buildings and electrical equipment, 1d.; and the remainder to miscellaneous charges. Probably this item for the permanent way and road maintenance may be of interest to Mr. Munro. Purely road construction and maintenance is accountable for 1½d. per car-mile. It must be taken into account, however, in Bournemouth that this applies to wood paved roads.

DISCUSSION.

The Chairman—There are probably one or two points in Mr Bulfin's remarks which we should not—I speak as a layman—all agree with, but it is a matter for the technical members rather than for one who occupies the position which I hold at present. I call for discussion on the paper.

Mr. C. J. Spencer (general manager, Tramways, London Underground Group of Companies)—Mr. Chairman, along with the other members of the Congress, I have listened with great interest to the very interesting paper of Mr. Bulfin on the Bournemouth system. Mr. Bulfin, in the summary of his paper which he has given us this morning, has pointed out something which I think we all know fairly well, namely, that very peculiar difficulties occur when a system has got well on in years, and a track of new rails becomes necessary. The result is that the wheels try to perform an impossible task, and spoil themselves and the new rails at the same time. Mr. Bulfin has mentioned the desirability of hardening the rail, and I find myself in absolute agreement with him on one point at least, namely, that it is desirable for the new rail to get fairly well bedded to its new environment and for the wheel to have formed its shape, before the surface is hardened and made permanent. I am much interested to hear that Mr. Bulfin is convinced that owing to the hardening of the rail in the way he mentions corrugations have disappeared.

Those of us who have been in the tramway world for many years have discussed this corrugation problem at considerable length. I remember one well-known tramway manager saying years ago that if someone could find a cure for corrugation he ought to be a millionaire very quickly. If Mr. Sandberg has found a cure for corrugation, I hope that this result may ensue. If we are certain that a cure for this great evil has been found, then I think inspection of this alone will have been worth the visit to Bournemouth.

In the paper Mr. Bulfin has written I see some mention of the Sorbitic and the *in situ* process. I must confess to some haziness as to what is Sorbitic and what is *in situ*. My difficulty in understanding Sorbitic may arise from the fact that I am not a steel man; I understand it is a question of steel structure. I recently sent for analysis a sample of steel which was rolled in America, and so far as I know had nothing whatever to do with the process known as Sorbitic over on this side, and the analyst reported that this steel was sorbitic in structure. That I understand to be some condition of the steel, and not in any sense to be confused with the *in situ* process. As a person seeking information, however, I should like a little more clarity on that point. I believe that in the minds of most tramway men there is a good deal of confusion between what is "sorbitic" and what is *in situ*. It is an extremely valuable thing to get a rail which will keep its contour, and that is the novel point which Mr. Bulfin has brought before us this morning. He has adopted a system which retains the rail shape. Years ago Mr. Bulfin was greatly concerned about a very common rolling stock problem, which goes by different names; some people speak of the "jazzing" car, others of the "tail-wagging" or "fox-trot" or "tango" car, but as tramway men we all know what is meant. It is a method of progression not pleasant for the passenger nor good for the car. If Mr. Bulfin could tell us anything with regard to this phenomenon which would help us we should be much obliged to him. In my own experience I find that if I can get a wheel which has not got a full throat—a throat that collides with a similar throat on the gauge-point of the rail—I get a car which runs easily and steadily, and does not "jazz." If Mr. Bulfin could give us any information on this very important and burning subject of "jazzing" cars I think we should all feel much indebted.

Mr. Arthur Norton (Brown Bayley's Steel Works, Limited)—Mr. Bulfin has referred to the worn angle of inclination of the rail-head. I should like to point out that when certain portions of the track are re-laid with new rails, the heads of which have an angle of inclination of 1 in 21, a very considerable difference in the angle of inclination is manifest when compared with that obtaining in the worn portion of the track. I should therefore like to suggest that when placing new wheels in service, or re-turning worn wheels, the angle of inclination of the tread of the tyre be kept in mind, and be made so as to conform with the angle of inclination of the tyre treads as worn—say 1 in 10 or 1 in 15, or whatever it may be. This angle of inclination is very easily ascertained by gauging all the worn wheels that may happen to be in the depot at any given time, and will be found to be more or less constant for a particular system, but will be found to vary as between different systems, due to the different working conditions and width of tyre employed. A narrow tyre under the same conditions will cone very much more rapidly than a wider tyre.

On the question of the life of rails, it would be interesting if Mr. Bulfin would state the analysis of the rails used on the Bournemouth system. I think it will be generally agreed that a very considerable advantage from the wearing standpoint would accrue if a very much harder rail were adopted at the outset, especially if the analysis of the rail were to conform more closely to that of the tyre. Of later years there has been an ever growing tendency on the part of the users to demand harder tyres, and whereas formerly a maximum tensile strength of 60 tons per square inch was considered to be the maximum hardness to which it was desirable to go, hardened and tempered tyres of 70-80 tons per square inch are now in service. This limit of hardness is governed by the difficulty of machining the material when the 80 ton mark is exceeded, but if a grinding plant similar to that which was formerly in use for cast-iron chilled wheels were available, there is no reason why this limit of hardness should not be exceeded.

Mr. Spencer has referred to the "jazzing," otherwise "tail-wagging," of cars. In the course of my investigations on the wear of car tyres, I have frequently observed a very considerable difference in the diameters of the worn wheels on the same axle—in fact as big a difference as ⅜ in. was recorded in one case. It is fair to assume that this variation in wheel diameters may be a contributory and deciding cause of the "jazzing" referred to. In addition the slipping of the wheels due to the varying diameters contributes to the corrugation of the rails. It frequently happens that tyres when once put into service are run through their life without being re-turned or touched in any way, and when the diameters vary it follows that the profiles of the tyres become distorted. Further, the width of the flange of the smaller wheel, owing to the inside face being continually forced up against the rail-head, is reduced by 50 to 60 per cent., and in some cases even more. On the other hand, the flange of the larger wheel creeps towards the centre of the tread, and results in an extremely distorted profile. On one system a pair of tyres had an actual worn thickness of $\frac{1}{16}$ in., and had it not been that the shrinkage was very carefully attended to, and the flanges of the tyres well maintained, those tyres would have worked loose long before this remarkable result had been achieved.

Mr. A. W. A. Chivers (inspecting officer, British Electrical Federation Limited)—The last two speakers have touched on a point which is of interest to us all, namely, the question of corrugations. I have been particularly interested in what Mr. Bulfin told us in his opening remarks with regard to the results obtained by the Sandberg rail treatment *in situ*. I think it raises the important point mentioned by Mr. Norton—the analysis of the rails. Nothing so far has been said as to the merits of employing a harder rail at the offset. Quite recently I was engaged in considering this matter as a member of a joint committee of this Association and the Municipal Tramways Association, and we obtained from tramway managers some very interesting data on the question of rail wear. It was clearly indicated by the particulars collected that the harder rails have generally speaking given much better results from the point of view of wear, and, needless to say, are less liable to the formation of corrugations. I think I am right in saying that there is a general feeling among tramway operators that our standard rails would produce much better results if they were harder. Hard rails—much harder than the British Standards Committee's specification—have been used to a large extent in this country, and comparisons that have been made have shown conclusively that there is much to be said in favour of the harder rail. I think this question of rail hardness is one which deserves the close consideration of all those responsible for re-laying tramway tracks.

There is only one other point on which I would like to touch. Mr. Bulfin, in his description of the Bournemouth tramways, says that the Bournemouth Corporation could not charge higher fares in Poole area than the British Electric Traction Company were charging in 1903. "This condition placed the Bournemouth

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Corporation in the position of not being able to make use of the Tramways (Increase of Charges) Act until March 1921, when the Bournemouth Corporation undertook to take over the whole of the outstanding loan charges on the Poole undertaking." I cannot quite understand that, because in several cases with which I am connected we had agreements with local authorities limiting the fares that could be charged, but if I remember rightly the Tramways (Increase of Charges) Act gave powers for the granting of increased fares, "notwithstanding any agreements which may exist to the contrary," and we have in several instances obtained higher fares under that Act notwithstanding such agreements. Even if he could not have obtained powers under that Act, I fail to see why the necessary fare charging powers could not have been obtained under the Courts Emergency Act—a procedure which was adopted with success by us.

Mr. A. H. Walton.—I would like to ask whether Mr. Bulfin attempts to grind down the rail to the correct profile. If you take a worn track, such as he explained to us existed in Bournemouth, obviously there are various profiles all over the system. I would like to know what his method of procedure is. Does he attempt to get some mean or average profile and so bring back uniformity to the most practical and workable profile he can find?

Mr. W. V. Edwards (general manager and electrical engineer, Hastings and District Tramways Company).—In connection with the remarks made about "jazzing" cars, it is very well known that this phenomenon is due principally to the difference of wheel diameter. For seven years we ran on a portion of the track with which I am connected cars fitted with petrol electric generating sets. The sets were placed under the staircase at one end of the car and we found that the cars "jazzed" tremendously, and in every case the car wheel nearest the generating set was found to have worn much smaller than the others. We experimented by varying the car wheel diameters, and in the end we got down to normal by putting in a wheel the circumference of which was ⅜ in. bigger than the corresponding wheel on the same axle. We found that under such conditions the car with this heavily loaded corner would run without undue "jazzing," and when we took the wheels out because they needed re-turning, we found that they were of practically the same diameter. Many other tramway people have done more or less the same thing. Of course we are free from this trouble now, as lately we ceased to use the petrol equipment.

Mr. Richard Humphries (engineer, Birmingham and Midland Tramways Joint Committee).—Primarily I rise to compliment Mr. Bulfin on his most excellent service in Bournemouth. It is, I think, a direct reply to the rather pessimistic paper that we are to have from Mr. Spencer later in our proceedings. In the next place I want to remark upon the strangeness of the line which the discussion on the paper has taken. One would never have thought that we should have got into the deep waters of the angle of inclination. My experience has been a very long one, and I have found, after many years, that both wheels and rails rapidly get down to an angle of 1 in 12. If there are any gentlemen here to-day who have any influence with the British Standards Committee I would beg of them to use it in order to get the committee to reconsider the angle of 1 in 21, because I have never, in the whole of my experience, nor in discussion with other engineers, found any system where 1 in 21 is maintained for any considerable period of running. My own experience, as I say, has been 1 in 12, and that of other people has been 1 in 10 or 1 in 15, but 1 in 21, as I think the audience will agree, is never maintained for any length of time. Why therefore not put in originally a rail with correct angle? Surely that in itself is the line of least resistance, and is better than laying a rail of 1 in 21, and doing what Mr. Bulfin has had to do, namely, wait for a considerable period of time, grind off the rail head, and then harden by treating the rail head *in situ*. We are all of us hoping for great things from this *in situ* hardening, but before we set to work upon it I think we should try to get the rail right.

Mr. R. G. Cunliffe (Metropolitan-Vickers Electrical Company, Limited).—With regard to the Sorbitic treatment, in 1913, in collaboration with Professor Alfred Schwartz, I carried out a long series of observations, and we constructed a machine which would produce corrugations on every material. We tried bars of wood, cement, and every metal in commercial use, and we produced corrugations similar to the type of corrugation with which tramway men are familiar. We found that the extent of corrugation depended on the nature of the material, but we could find no steel, however hard, on which we could not produce these corrugations. In the case of rails treated by the *in situ* process, there probably has not been time for the corrugations to develop. Until the cause of corrugations is removed you will continue to have the effect, and you are no nearer to removing the cause with the hardened rail than with the softer one. The development of the corrugations is only a matter of time.

Mr. Bulfin, replying to the discussion, said—In reply to Mr. Spencer's remark, the *in situ* process is simply the application of the heat or the Sorbitic treatment to the rail in the ground, in the position which it is to occupy permanently. The only difference between the Sorbitic and the *in situ* treatment is that the one is carried out at the works previously, and the other is carried out in position on the line. With regard to the "jazzing" of cars, we have had a great difficulty with the single truck cars, but on investigation I found that this invariably arose from the fact that one motor was moving in opposition to the other sideways, and I was able to get rid of the difficulty by intercommunicating the two motors, so that the motion of one destroyed that of the other. I have introduced stops to prevent the motor from working in this way, and by this means I was able to reduce the "jazzing" in the car by 50 or 60 per cent. With regard to what Mr. Norton has said, I have always insisted that if a tyre comes in with a certain grade, say 1 in 9 or 1 in 14, it is not to go down to 1 in 21, but to be turned down to the grade as nearly as possible at which it comes in. With regard to the analysis of the rails, I entirely agree with Mr. Norton. We had in Bournemouth a very hard steel rail on the conduit system, and we never had a single corrugation on that line, but these rails had the disadvantage that they could not be crowed. They were so brittle that the application of the crow cracked them at once, so that it does follow that the hardness and structure of the rail has a great deal to do with whether corrugations appear or not. The harder the material, the less chance there is of corrugations being formed.

A question has been raised as to the Poole fares. The British Electric Traction Company originally laid a light railway from County Gates to Poole, and, wishing to popularise the line, gave very cheap fares. When we took over that line a clause was put in the agreement that we could not at any time increase the charges above those obtaining in 1903. When the Tramways (Temporary Increase of Charges) Act came in, it provided that the undertakers could apply these increased charges; but we were not the undertakers. The Poole Corporation were the undertakers, and we were the leaseholders, and the Poole Corporation were not likely to apply to the Ministry of Transport under such circumstances for permission to raise the fares. With regard to Mr. Walton's remarks on the profile of the rail, I always like to let the rail wear down as far as possible to what it wants. I quite agree with Mr. Humphries that an angle of inclination of 1 in 21 is absolutely out of the question after any considerable running. That is a matter for consideration of specifications of rails by the British Standards Committee. Probably in laying down a grade of 1 in 21 they had regard to other traffic on the road, and believed that with a rail of this angle the wheels of other vehicles were less likely to catch.

The Chairman.—We have all listened with very great interest to Mr. Bulfin's paper, and we thank him for it and for the very useful discussion it has elicited. I propose a hearty vote of thanks to him.

Alderman R. A. Smithson.—I have pleasure in seconding. It has been one of the most practical and entertaining papers to which I have listened for many years, and we are very much indebted to Mr. Bulfin.

The vote of thanks was accorded by acclamation.

The Chairman, in calling upon Mr. E. M. Munro to introduce his paper, "Notes on Railless Traction," which was given in full with numerous illustrations in THE TRAMWAY AND RAILWAY WORLD of June 15, said—This paper presents many points of value for discussion by tramway men. I am not very competent to speak on the matter, but it seems to me that the indications presented by this paper are very unfavourable to the continuance of tramways on rails. Whether that is borne out by the experience that has been gained at present, or whether it is likely to be borne out by the developments of the future, is not for me to say; but I have no doubt that a good many of you here have your own views on the subject, and we shall be very glad to listen to them.

Mr. Munro then briefly summarised his paper, bringing out some of its more salient features.

NOTES ON RAILLESS TRACTION.

DISCUSSION ON MR. MUNRO'S PAPER.

A Member asked what proportion of accidents occurred on railless cars as compared with track cars.

Mr. R. G. Cunliffe (Metropolitan-Vickers Electrical Company Limited).—I should be inclined to take exception to the figures given by Mr. Munro in his Table I. for the ordinary tramcar. It is a mistake either to overstate or understate the case in favour of one type of vehicle. Mr. Munro gives as the rate of energy consumption for tramcars 2 K.W.H. per car-mile. That is much too high. The average for the whole country, including large systems and small ones, would be nearer 1·6 than 2. He also gives the average speed of railless cars and the petrol omnibus as 8 miles per

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hour, and that of the tramcar as 7·5 miles. I think 8 miles per hour would be more applicable as the average speed of the tramcar also. He assumes also that a larger drop in voltage can be taken in the case of trackless; I think that suggestion is a retrograde step. The maintenance of voltage ought to be a strong point. If the voltage be reduced on the railless system, not only is there a drop in speed, but there is an increase in energy consumption. I think it would be wiser to make the necessary outlay of copper and maintain the voltage. The motors are more efficient on the full than on the lower voltage, and the working results in every way would be better if the voltage were maintained. The extra cost of copper would be more than balanced by the saving. I look on this question of the trackless trolley from the manufacturer's point of view. In the past the failure of the trackless trolley vehicles has in my opinion been due very largely to the unsuitability of the equipment. The chassis and the omnibuses themselves have followed motor omnibus lines, and the electrical equipment has been added to vehicles not designed for the purpose. The result has not been suitable for ordinary running conditions. The tendency of the present moment is to design special equipment for the trackless trolley, and several large firms are considering it carefully from that point of view. The thing that has struck me is the large number of tramway authorities who possess trackless powers, but are not exercising them. They are waiting for a type of equipment to be evolved which they can see is going to be suitable to their conditions, and they are probably waiting also for somebody to take the lead. But the fact remains that there are several large undertakings in the country which have powers in this matter, and are not exercising them nor apparently intending to exercise them. There are two sets of conditions to bear in mind. The design is affected by traffic considerations and by engineering considerations. Traffic considerations affect the operative side more than the manufacturing side; the engineering considerations do very strongly affect the manufacturer. The points to be settled from the traffic side are, amongst others, the design of body, distribution of weight—particularly the large weights now being put upon the axles—seating capacity, and general outline. The manufacturing conditions include the type of chassis, and the much debated question of single versus two-motor drive. This last is to me a fundamental point. With the single motor drive your rheostat losses are greater, and your general efficiency and control are lessened. With numerous stops—say in the city portion of a track—the two-motor drive has the advantage all the time. Another point is whether there should be foot control or hand control. In the past the controller has been the tramway type of controller alongside the driver, so that the driver has to take his hands off the steering wheel to operate the controller. With the later designs the driver is able to keep both hands on the steering wheel, and operate the controller by foot. The discussion, I think, ought to shed some light on these points.

Mr. H. England (managing director, Yorkshire (West Riding) Electric Tramways Company).—A larger question than the ordinary engineering question is raised by this paper. We have first of all to consider how trackless vehicles should be employed and the conditions for which they will be suitable. A year or two ago many of us formed the opinion that the cost of reconstructing tramways would put tramways out of court; but conditions have changed enormously since then, and are changing all the time, entirely in favour of tramways. The reconstruction of a tramway that was impossible two years ago has now become a feasible proposition. The competition of independent vehicles—trackless vehicles, both of the petrol type and the electric type—has assumed an entirely different phase. There is, however, an opening for railless vehicles to supersede tramways which are worn out, and which should never have been constructed originally. Many of us know of places in this country where tramways have been laid down which were economically unsound when they were designed. I am now referring to a tramway where a headway is maintained of, say, 15 minutes or less. For my own part, as a counsel of perfection, I should say that a tramway is only permissible where it is possible to run an average 10 minutes' service, and a railless is called for when anything from this up to a 30 minutes' service can be run. I am dealing entirely with provincial conditions, not with London, and perhaps not with big city conditions. Speaking of the country generally, that is the formula I should adopt.

You have to consider, too, whether the railless system is preferable to the motor omnibus. If you mention that point to the man in the street he says that you are bowled out on the ground of elasticity. But we are traffic men, and if we are running from point A to point B, it does not matter from the elastic standpoint whether it is a railless car or a motor omnibus, so that the question of elasticity does not appeal to me. I think a railless system is particularly adapted to supersede an uneconomic existing tramway system; but if the overhead cables have to be provided, and Parliamentary powers have to be obtained, it is a different matter. The railless, in years past, has suffered very much from faulty design, but I join issue with the reader of the paper as to the cause of that fault. The fault was not in the motors; and I think that the experience of both my neighbours at Leeds and other places has proved that electrical faults have been very very small indeed. The fault has been in the transmission. In one place, had it not been for transmission faults they would have been able to keep their vehicles on the roads and to acheve better results. I think I am correct in stating that in the instance to which I refer an order was given to the best gear makers in the world to design a gear, and even that gear failed in operation. Leeds has now adopted another vehicle of an entirely different type, and this seems to have a better chance of succeeding. Speaking on the general question, whether railless vehicles are going to supersede tramcars, I should say, under ordinary circumstances, emphatically no; but under exceptional circumstances, in very small places, they will have a chance. As to whether they are on the whole better vehicles than petrol omnibuses, I shall keep for the present an open mind.

Mr. C. J. Spencer—This is a subject on which I have had some experience in the past, and in which I have still a great interest. Whatever may be said of Mr. England, we cannot call him partisan. He takes a detached view, and seems prepared to come down in favour of any one form of traction. Recently, when I was talking about railless traction with a gentlemen prominent in the motor omnibus world, my friend made the remark, "Railless traction is the tramway man's last hope." I do not agree with that, but that is the general view outside tramway circles. It is a common idea that the tramway man believes tramcars to be hopeless, and that, not wanting to go over to the motor omnibus, he finds out some new idea, takes that up, and makes the best of it. If I might say so, that is absolutely wrong; those of us who have been connected with railless traction for a long time know it to be wrong. I think that the era of railless traction has only just dawned, and is by no means a last hope. Looking at the matter from a broader point of view, I would like to refer to a portion of the paper by Mr. Munro in which my name occurs. He says—"The point at which the railless car ceases to be more economical than the petrol omnibus in regular service has been variously estimated between 30 and 45 minutes' headway. Mr. C. J. Spencer contributed an article in which this was dealt with at the June 1913, meeting of the Managers' Section of the Municipal Tramways Association, and at that time placed this point somewhat higher." I remember reading that paper, but I have not seen it for a good many years. I do recollect, however, that the broad argument was that there was a field for the railless traction system somewhere between the tramway and the motor omnibus. Only, so far as I can see, if we accept the statement of Mr. R. H. Wilkinson, my successor at Bradford, the field is so wide that there is no room for anything but railless cars in the future. I do hope that no one will imagine that I agree with Mr Munro or with Mr. Wilkinson. I do not think that many omnibus services have headways of more than 45 minutes. I incline more to the view—and if I remember rightly that is what I said on the occasion referred to—expressed by Mr. England, that with a shorter headway of 10 minutes or less, taking everything into account, the tramway did at that time hold its own, and I think the day is fast approaching when it will hold its own again. It will hold its own on the double basis of economy—since it is the most profitable vehicle—and passenger convenience, including the capability of handling the biggest loads and giving altogether the best service. With a slower headway, up to half an hour, it is doubtful whether the capital charges, including the overhead equipment, do not become so high that the motor omnibus, with its rather higher operating expense, is the better vehicle. My own observations rather lead me to that conclusion. Recently, within the last month, I have had the opportunity of visiting a good many tramway systems in England and Scotland, and it may interest you to hear the general impressions which I received at the various places. I find that the general opinion is held amongst men who have had experience with all types of vehicles that on a reasonably short headway the railless car system is operating at about 60 per cent. of the cost of a motor omnibus system. That was the opinion expressed at York, where they have three systems of traction—railless, motor omnibus, and tramcar—and where the motor omnibus and railless cars are very similar in size, being, I think, both one-man vehicles, and should have a similar operating cost.

On the question of design I join issue with Mr. Cunliffe. He told us that the fault of the past was that the designers of railless traction had attempted to put an electric motor on to an ordinarily designed omnibus chassis. That is exactly what they did not do, and what I believe they ought to have done. They designed the chassis almost entirely without regard to the motor omnibus. The transmission was a double reduction transmission, and the power was transmitted by chain to the rear axle. Very early serious troubles developed, and that form of transmission was found to be impossible. The next form of transmission was a direct drive, without the interposition of a chain, on to the back axle by means

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of worm and the worm wheels and propeller shaft. Mr. England has told us that the best firm of gear makers were employed, and he has rather hinted that that form of transmission proved a failure. Well, I have not been in touch for a few years with the particular vehicles so constructed, but I can say that they were not a failure. The trouble was not with the worm or the worm-drive or the worm gear; the trouble was in the design of the back axle. The latest vehicles I have seen, and the vehicles which seem to be giving very great satisfaction indeed, are vehicles which have been primarily designed for petrol traction. The engine and gear box have been taken out, and the motor has been put in their place, taking the same back axle and the same gear that was there for the petrol engine. Those vehicles seem to me to give very great satisfaction; they are certainly running very smoothly indeed, and according to the manager of the Middlesbrough system not a cent has been spent upon the maintenance of that vehicle since it started about last November, and it has been in constant running since. It certainly runs very smoothly. It does seem to me to be correct practice to adopt the best that we can of the motor omnibus design, and merely add our electrical equipment to it. I agree, of course, that something ought to be done in the way of better controllers. We should not be content merely to stick a tramway controller on to the platform. But that is merely a detail. The control can be worked by foot just as well as by hand. The best railless car I know, on general principles—and I am not one to depreciate anyone else's ideas—is a petrol omnibus chassis with a motor in place of the engine and gear box. At Leeds a vehicle has been designed which has great possibilities, with the front wheel drive. I have been speaking of the single motor; I do not want it to be understood that I am saying anything against the possibilities of a front wheel drive vehicle.

I should like to ventilate just a little further this question of single versus double motor equipment. I know that on paper and in theory a series parallel control which involves two motors should tend very greatly to economy in current. But I wonder how far it does so. I have been watching some tests in London with single motor equipment and ordinary rheostat, and the current consumption of the vehicle under all service conditions was quite equal to that of a double motor series parallel control. The fact of the matter is, the driver does not run his car on his rheostat notches. He generally puts down his pedal and floats the rest. There is not a great deal of running, except at special points, at full parallel speeds. In my paper to be read later I want to speak about the possibilities of shunt motors. A shunt motor eliminates this question of uneconomical running, and it is up to some of our electrical people to see how far the shunt motor can be adapted rather than have a running with a complication of two motors, with this complexity of gears and transmission rods, and so on. I appreciate Mr. Munro's paper very much, and there is one question I should like to ask him—why should a railless car be heavier than a petrol omnibus? Surely it should be lighter, not heavier. According to Mr. Munro's figures, the petrol vehicle is the lighter of the two. Petrol vehicle design is a bigger problem than railless car design. I think our railless people ought to give us a lighter car for the same capacity than the petrol omnibus.

Mr. J. Steven Hamilton (engineer, Leeds Corporation Tramways).—We have operated tramways in Leeds since about 1895, motor omnibuses since 1905, and railless since 1911, and these three systems have parcelled themselves out into separate spheres. We find that the tramways can be operated most economically up to one-quarter hours' service, the railless from one-quarter hour to three-quarter hour, and the motor omnibus from three-quarter hour onwards. We have had motor omnibuses running on an hourly service, with a lay-off of two hours in the depot. With railless we started in 1911 with the type mentioned by Mr. Spencer, and we had the same troubles as Mr. Spencer had, first with the chain drive and then with the shaft drive; and now we have come down to what is known as the front drive system—that is, we take the drive from the back axle on to the front and cut out all transmission, so getting a direct drive. All our trouble to start with was transmission. The gear was good, the back axle was bad, in fact the whole of the transmission was not suitably designed for an electric motor; and when Mr. Bishop, who is the inventor of this front drive, came along, and said that he had found something which would cure our troubles, we welcomed him with open arms. We have been working with the front drive since 1920. In the double-deckers we seat 59, which is a greater seating capacity than that of our tramcars, and we have been running them over two routes with an average gradient of 1 in 20. The current consumption has been 1½ units per car-mile, which is rather less than the figure (1·66) put down by Mr. Munro. Mr. Cunliffe spoke of two units per car-mile as being rather great for a tramcar. We have in Leeds a consumption of 0·83 with the back axle drive, both chain and shaft drive, and with the front drive single decker we get 0·75 unit per car-mile—a saving of about 10 per cent. I do not propose to go into the reasons for that saving in cost, but those are the actual results. With regard to the development of railless over tramways, we in Leeds have had the same trouble already referred to by other speakers. We have one route which requires re-laying. The service on that route is never better than one-quarter hour, and averages about 20 minutes. We are taking up that tramway, and do not propose to re-lay; we intend to run railless where we formerly ran tramway. That may be extended when we see how this experiment works out. I should wish to say that from our experience with railless we do certainly find that it is much more economical to run them than to run motor omnibuses, and the figure that Mr. Spencer gave as the ratio of the cost of railless to motor omnibus—60 per cent.—is not far out in the case of Leeds.

Alderman R. A. Smithson (chairman, Leeds Corporation Tramways Committee).—Mr. Hamilton has dealt with the practical aspect of our experience in Leeds with the various forms of traction and the troubles which have arisen from the management point of view. The word I wish to add is more on the general question of policy. As chairman of the committee there, I should not like it to be thought by any gentlemen here to-day that Leeds has lost faith in tramways as tramways. Certainly, when the period arrived for the re-laying of one particular section, we abandoned tramways and instituted railless traction, but that is on an odd mile of a thinly used route. We have still some 110 miles of tramways, and I think when I mention that during the past year we spent something over £150,000 on tram rail renewals—renewals of the permanent way—alone, and have laid our plans for a similar amount of money to be spent this year, it will be seen that we have not by any means lost faith in tramways. I am quite comfortable in my own mind as to the future of our tramway undertaking. I am satisfied that for large and largely populated areas, particularly industrial areas, where the traffic is regular and dense, there is nothing yet evolved to equal the tramcar, both in economy of working and convenience to the public. In this country I think the field is sufficiently large for all these three modes of transit to work and work successfully, particularly so where it is possible to work them in conjunction. We are in Leeds endeavouring to do so, and adapting ourselves to the altered conditions and costs of traffic. But I do want to make myself quite clear on this point, that we have not by any means lost confidence or faith in the future of our tramways undertakings as investments.

Mr. E. H. Edwardes (general manager and engineer, Lancashire United Tramways Limited).—I should like to take this opportunity of thanking Mr. Munro for his paper. I have been thinking about trackless trolleys for some years, especially on a system such as the one with which I am connected—some 40 miles' route, considerably more than half of which does not call for a more frequent service than 20 minutes. This fact makes one wonder whether that portion of the system can ever be reconstructed with rails. I must say I am rather disappointed that Mr. Munro has not given us more particulars as to the working costs of a trackless system; but I take it he does not really know what they are. He has given us some information as to the cost of power, but I agree with the previous speaker that it seems a little unfair to the tramcar when he takes 2 units as the energy consumption per car-mile, costing 3d., and the energy per car-mile of the motor omnibus as costing 4·359d. I know a very large company's omnibus service—one of the best in the kingdom—the cost per omnibus-mile of which is in the neighbourhood of 2·6d., not much more than half Mr. Munro's figure. I am still not satisfied that the tramways are finished with. They have a lot of "kick" left in them. Except for the track they are the cheapest form of traction, and as for the track, is this altogether the tramway's responsibility? Is the cost of the track due to the wear and tear of the trams or the wear and tear of other vehicles? A very great amount of wear on the rails and on the track in general is due to other traffic. Who is going to pay for the roads in the case of the trackless trolleys? At present they are taxed on the seating capacity. But will that meet the expenses? We are never quite sure what road maintenance under the trackless trolley system is going to cost. It might cost as much, possibly, as the repairing of the tramway. That is a point we ought to bear in mind.

Mr. Richard Humphries.—Whilst thanking Mr. Munro for his paper, can we turn, with a trackless trolley, a loss of £3,000 per annum to a profit of £3,000 per annum? I should imagine that the figures on which he bases his statements were got out at the peak of reconstruction cost, when rails were £26 per ton, and all other material as well as the cost of labour was at its highest. If that estimate was gone into again to-day I believe that there would be a very different result. I must ask everyone present not to be too pessimistic over track reconstruction costs. Going on to the details of the paper, I notice what he has to say with regard to speed of tramcars versus speed of railless. I wonder whether he is comparing like with like. Undoubtedly the figures given us are based on statistics, but statistics are, as everyone knows, slippery. The average speed of 7·5 miles per hour for trams is surely taken from very large urban services, while the speed of railless given is for

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suburban services, so that we are not comparing like with like. As against this 7·5 miles per hour, Mr. Spencer has on his system to-day cars operating at an average speed of 9·19 miles per hour. Reconstruction on rational lines, while holding our existing concrete beds, and re-using sett pavings wherever possible, will not, I think in the near future be such an insoluble problem. We are told in the paper that with a 2-minute headway railless is more economical than a double-line tramway, but more costly than a single line. Is there any single-line tramway with a 2-minute headway? I think to-day's discussion has narrowed down the matter, and what we must ask the railless people to do is to show us, between a 10-minute and a 30-minute service, what they can do better than the motor omnibus.

Mr. E. M. Munro, replying on the discussion, said—With reference to the Chairman's remark on the pessimistic view I am supposed to have taken of tramways, what I meant to say was that undoubtedly the railless car had a great future before it, and it would cut into a tramway undertaking. I have been asked whether the railless car is more liable to accidents than the tramcar. No; the accidents have been of a very minor character. Mr. Cunliffe commented on the amount of energy consumption I had put down for double-deck cars. That was an average between the figures obtained from several installations, in comparing like with like. If the energy consumption, 1·6 K.W.H. per car-mile, mentioned by Mr. Cunliffe were taken as the average, then the number of passengers carried per mile would have to be averaged to get the energy consumption per passenger mile, and I think the figure given in my table would be unchanged by this alternative method. Again, as to speed, 8 miles per hour was the average speed for railless on the systems from which I got this information. I am quite aware that the London County Council Tramways are running at a much higher speed than that. With regard to the question of voltage, I am afraid my paper was not quite clear. The direct current motors for the railless cars we work are wound for 500 or 525 volts; it was not suggested that this 600 should be used in any other way than to overcome the drop natural to the railless system. I was thinking of motors wound for 525, and have come across these motors running on systems where there was a 200-volt drop. Mr. Cunliffe also commented on the slow-speed motors which have been used. But my experience with railless is that high speed motors have been used. I believe that some tramway type of motor has been employed, but only in one or two cases. With regard to the distribution of weight, that is a very important point. With the increasing size of railless cars and the limiting of axle loads to five tons, the redistribution of weight becomes necessary, and we might easily get to 5-ton front axle loads. One or two speakers have mentioned the single motor as opposed to the two-motor equipment. I have recently had the opportunity of seeing some comparative tests made; I do not wish to say too much about the figures until they are verified, but on a straight run without stops the single motor was very slightly more efficient than the two-motor equipment. However, where 15 stops were made in about five miles—three per mile—there was a very considerably greater consumption on the single motor than on the two-motor system. The figures showed that with stops at the rate of one-and-a-half per mile there was a difference of 24 per cent. in favour of the series parallel control.

Mr. England has referred to the question of cost. Some time ago the costs of tramway construction were very high indeed. They are now coming down, but the costs for railless are also coming down, so that it may be assumed that the relative results will be the same. Mr. England also commented on transmission faults, due to weaknesses. When railless was first essayed no one realised the severe loads that were going to be put upon transmission gears. Mr. Spencer made some interesting comments on the chassis design. The first of these was more or less copied from the then general practice with petrol vehicles, and the form of transmission selected was then thought to be quite an innovation, inasmuch as we had a single worm gear for the first reduction, and chain reduction afterwards. It was agreed to have half the reduction on worms and half on chains, but the results were not, as Mr. Spencer told us, satisfactory. The reason was that the gears would not stand the high torques transmitted from the motors.

As regards the York chassis, four vehicles were supplied to York 16 months ago, and have run continuously without the slightest repair being necessary at all. They have the single worm drive and series parallel control. With regard to the shunt motor, to which Mr. Spencer referred, no doubt the adoption of the shunt motor with speed change gear would eliminate all rheostatic losses. The shunt motor has been tried before in the tramways service, and then it was a failure because the motors were continually in circuit and got too warm. The motors ought to have been specially designed for that work. Mr. Hamilton says that on his double-deck railless car he gets 1·5 units per car-mile measured on the car, and 0·83 on the single-deck car, and 0·75 with the front axle drive; these are very good figures indeed. Mr. Edwards commented on the roads, and asked who paid for the roads in the case of railless cars. That is a vexed question; it may be some time yet before the liability is distributed proportionately. Mr. Humphries made some remarks about the cost of the petrol omnibus as shown in my paper. I assure Mr. Humphries I got it from one of the largest systems, and I think it compares with costs from other systems nearly as large. As for the speed of 7·5 miles given for the tramway, this is possibly on the low side in many cases, but desiring to compare like with like, I got that speed from a route on which railless is going to supersede the tramway.

A very cordial vote of thanks was accorded to Mr. Munro for his paper, and the morning's session was then closed.

DEMONSTRATIONS AT THE TRAMWAY DEPOT.

The members were then conveyed by motor omnibuses to the Corporation tramway sheds, where, by the kindness of Mr. Bulfin, the general manager, a demonstration was given of the Sandberg Sorbitic process of hardening rail treads *in situ*. An illustrated description of the process will be found in THE TRAMWAY AND RAILWAY WORLD of April, 1918. Since that time the system has been applied on many tramways with apparently very excellent results, and it is not surprising that the keenest interest was taken in the demonstration. After the process had been applied to a short length of rail, it was broken, so that the change in the structure of the tread of the rail could be examined, and tests showed that the metal was made harder to a depth of ⅛ in. to ¼ in.

At the car sheds the members also had an opportunity of inspecting the new double-deck trackless car which has recently been constructed for Leeds Corporation, and was described and illustrated in THE TRAMWAY AND RAILWAY WORLD of June 15. This car is of a strikingly novel design which has been produced by Trackless Cars, Limited, of Leeds, and has seating capacity for 64 passengers—30 in the lower saloon and 34 in the upper. The driving unit is on a fore-carriage, the motors being carried fore and aft of the axle. The body work is in every way admirable, and reflects much credit on the Blackburn Aeroplane and Motor Company, Limited, of Leeds, by whom it was carried out. The car was run out on the tramways, was turned round and manipulated in such a way that the observers could have no doubt that it possessed sufficient flexibility for use even in thoroughfares crowded with traffic. The visitors were manifestly much interested by the *in situ* process, the trackless car, and other apparatus, and their keenness was beyond praise. One lady member of Bournemouth Tramways Committee not only braved the dust and heat of the day, but was heard to exclaim enthusiastically that she "wanted to see everything." It was possibly owing to her presence that the members, who were somewhat dilatory in returning to the Town Hall for luncheon, were able to make amends to the Mayor for their unpunctuality.

LUNCHEON AT THE TOWN HALL.

About 200 guests were entertained by the Mayor and members of the Tramways Committee at luncheon in a large hall in the Town Hall building, which was decorated with flags and bunting. The Mayor presided until another engagement compelled him to leave, and the chair was then taken by Mr. F. J. Webb. After the loyal toasts had been honoured, Mr. Tegetmeier expressed the thanks of the Association for the cordial welcome that had been extended to them.

After luncheon the members and ladies were taken in motor coaches around Bournemouth and vicinity, and were most hospitably entertained by Mrs. Bulfin to tea at Tuckton Creeks, a charming spot on the banks of the River Stour.

THE ANNUAL BUSINESS MEETING.

On Friday morning the annual general meeting was held in the Council Chamber of the Town Hall, the chairman of the Association, Mr. C. G. Tegetmeier presiding. The secretary (Mr. A. de Turckheim) read the notice convening the meeting and the report of the auditors. The Council's report was read by the chairman, and was adopted, together with the accounts for the year ended December 31, 1921. The report showed that much useful work had been done during the year, and it was received with cordial approval.

The chairman then moved the election of the members of the Council in place of those who retired, and by rule were ineligible for immediate re-election, viz., Messrs. Harvey, Holliday, Pickering, Spencer, Soames, and White.

The following gentlemen, who were nominated by the Council, were unanimously elected—

Mr. J. M. Calder, general manager, Reading Corporation Tramways.

Mr. C. H. Dade, of the British Electric Traction Company, Ltd.

Mr. H. England, managing director, Yorkshire (West Riding) Electric Tramways Company, Limited.

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Mr. W. E. Hardy, general manager, Bath Electric Tramways, Limited.

Mr. C. J. Jewell, general manager, Norwich Electric Tramways Company.

Mr. A. Norton, of Messrs. Brown Bayley's Steel Works, Limited.

The members learned with much regret that Colonel A. W. Chambers, who had given his services as honorary auditor since 1905, desired to be relieved, and the chairman expressed the deep thanks of the Association to Colonel Chambers for the valuable services he had rendered as auditor over a long term of years, and their best wishes to him on his relinquishing the position. Messrs. Wright, Wake, Price and Company were then elected auditors.

A cordial vote of thanks to Mr. C. G. Tegetmeier for presiding terminated the proceedings.

Mr. Tegetmeier again presided at the second session of the Congress, which immediately followed the business meeting, and invited Mr. C. J. Spencer to read his paper on

MODERN IMPROVEMENTS IN ROLLING STOCK.*

DISCUSSION.

Mr. Arthur Norton.—I should like to congratulate Mr. Spencer on having brought forward this very interesting paper. There is, however, one thing for which I have looked in vain, and that is some reference to the question of standardising the various parts of the modern tramway car. In the early days of the war, viz., in 1915, users were experiencing very great difficulty in obtaining their supplies of car tyres due in some measure to the great variety of sections and sizes in use. For example, the companies controlled by the British Electric Federation had some 30 or 40 different sections and sizes for doing the same job, the width of the tyres varying from 2½ in. to 3⅛ in. Upon approaching them, they very readily came to our aid in the matter, and as a result they adopted a standard section in three different widths, viz., 2½ in., 2¾ in., and 3 in., and by far the larger proportion of the tyres used by them are 2¾ in. in width. Following that we then approached this Association, and the Municipal Tramways Association, and a combined meeting with the tram tyre manufacturers took place, resulting in the three standard widths and sections being adopted. This was a good step forward, but we were still confronted with every system having its own particular diameter of wheel centre, so that the question of rolling tyres for stock remained, and still remains, an impossible one. In our extremity we approached the British Standards Association, who at the termination of hostilities appointed a panel with a view to drawing up a standard specification on tramway tyres and wheel centres. These specifications, No. 101 for car tyres issued in 1921, and No. 149 for wrought-iron wheel centres and No. 150 for cast-steel wheel centres, were issued this year, the diameter of the driving wheel centre being fixed at 27 in., and the pony wheel centre at 17 in. It is worthy of comment that since those specifications were issued we have not had a single inquiry for a standard sized tyre, and I should like the members of this Association to give that matter their very serious consideration. Not only is it important from the manufacturer's point of view, it would be a very distinct gain to the user, and especially the small user, if he could purchase tyres from stock for immediate delivery. The same remarks apply in a greater or less degree to gears. The Municipal Tramways Committee recently appointed a special committee to consider the question of standardising gears, who have referred the matter to the consideration of the British Engineering Standards Committee. Here again there are an enormous number of different designs of gears, and whilst there are bound to be a variety of gears of varying ratios, there does not appear to be any unsurmountable reason why standard gears to suit the varying ratios should not be evolved and adopted.

Mr. Spencer also referred to the use of alloy steels in tramway cars. There is no doubt that alloy steels, correctly heat-treated, hardened and tempered, may be utilised to the very greatest advantage in the construction of tramway cars, and especially so with reference to car axles. It is possible so to treat an alloy steel, which before treatment would only give an impact up to 4 or 5 ft. lb., that it will give 40 to 50 ft. lb. after treatment. This is a very important factor in such a vital part of the tramway car as an axle, subjected as it is to violent alternating stresses, and it has been proved beyond doubt that axles with a high impact value will give a very much better life than similar axles with a low impact value.

There is also no reference in Mr. Spencer's paper to the question of roller bearings for tramcars, and it would be very interesting if members with experience of roller bearings would give the Congress some information regarding their behaviour and results in service.

The question of hardness of rails has also been touched upon, but as I said in my remarks on Mr. Bulfin's paper yesterday, I think it would be very much better to start with a much harder rail, which the Americans have supplied, and which according to one speaker had given a much better life than those rails supplied to the British Engineering Standard specification. This being so it seems to me a desirable thing that the British Standards Association should be advised, with a view to considering the question of increasing the hardness of the rail in the standard specification.

Mr. W. V. Edwards.—I should like to touch on the question of unsprung weight. Many years ago a motor was supplied by the Walker Company in which no unsprung weight was on the axle. I do not know what the objection was to that motor, but the Walker design was given up; possibly it was a question of patents. As far as I know it was quite satisfactory in working. I am very glad to hear from Mr. Norton that nobody has as yet ordered any standard tyres. The decision to make the diameter of wheel centre 27 in. was absolutely wrong. I think I mentioned this a year or two ago. We ourselves have several diameters of wheel centres, and we are, as occasion offers, changing them all to the biggest diameter we have. We do this in a very simple manner. We run the wheel as far as we can and get the tyre down as low as we can, and then it amounts to little more than turning off the rims of the flange and putting the rivets through the tyre as it stands on the rim and the rim itself, and using that as the new centre. All our new tyres therefore fit the biggest centre. This has an advantage from the operator's point of view, but not from the manufacturer's, for there is not half so much scrapping of the tyre as there used to be.

With regard to the standardisation of gears, the most effective way of arriving at that point—though not a very rapid one—would be to get several of the big manufacturers of the country to come together and agree to make their designs similar. It is very difficult for a tramway company, with a plant on its hands, to alter its design, whereas if all the new cars bought had gears of a certain design, and a motor to take the same gear, then eventually standardisation would be arrived at.

Mr. Richard Humphries.—After reading Mr. Spencer's paper in conjunction with its title, "Modern Improvements in Rolling Stock," I could not but think of the countryman who saw a giraffe for the first time. His only comment was, "There ain't no such thing." I would like to ask Mr. Spencer to throw his mind back to the old South Staffordshire Company operating from the Darlaston depot, and the fleet of cars that were then in operation, which some years ago I had to disperse. One of the trucks equipped with motors was very gratefully accepted by the South Kensington Museum. The bodies can be seen in the South Staffordshire area on allotments. Placing one of those cars alongside the latest London County Council car, can one really say that there have been no modern improvements in rolling stock? Then as for light-weight motors; for some years past in the Black Country we have run some G.E. motors that gave us exactly the same weight per horse-power that Mr. Spencer asks for as his ideal. The motor in question is the G.E. 264. The motor and pinion weigh 832 lb. At 600 volts it is rated at 32½ H.P., which gives us 25 lb. per H.P. The gear ratio is, of course, high; the speed is high, but that helps the ventilation. The pinion has only 13 teeth, the gear 100 teeth, but that motor, operated in conjunction with a car having a body weight suitable to its capacity, has given us very excellent results. That motor is operating on the car which the Brush Electrical Engineering Company are now building, a picture of which can be seen in their advertisement in the June journal of the Association. It has a body that I designed in 1917. We have some forty of these cars now in service on the five companies with which I am connected. They are also running in Barrow-in-Furness. Wolverhampton Corporation and Swansea have adopted this type of car. It has a front end exit on the near side, a completely vestibuled front, and the bulkheads have been abolished. It is peculiar, in rolling stock as in other things, how old ideas persist. It is not many years since that, if one looked at the railway coach, one could see the lines of the old stage coach; and for many years I have felt that the open-fronted car is a relic of the old horse-car days, when the driver had to have an open front in order to get his reins over. The sliding door and the bulkhead are relics of the open-fronted car. It has been a great source of interest to me to find that these light-weight motors I am speaking of have stood up to their work, and are running in conjunction with motors two or three times their weight. These bodies and motors can be seen by any gentleman who cares to come to the Black Country. We will show them in operation.

With regard to springing, wooden liners between centres and tyres were tried very many years ago. Fibre has greater possibilities, perhaps. Spring cushion seats may have to be given to the passenger. If we cannot give spring on the axles, we can easily give it in closer proximity to the passenger. Then again, is there any possibility in single-end operation? While I was living in America I found that the single-end operated cars there undoubtedly lent themselves better to passenger comfort and service than the

* The full text of Mr. Spencer's paper was given in THE TRAMWAY AND RAILWAY WORLD of June 15, 1922.

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double-end cars. To have the rear end of the car encumbered with brakes and controllers, and all the apparatus for the driver, is rather crude. If the whole of that rear end is thrown into passenger service it leads to a far more roomy and comfortable car than any of the existing types. The difficulty at the terminus can easily be got over, at least in many areas, by putting down a triangle, and as for sleeper track, I have in the Black Country many miles of transverse sleeper track. The cars run sweet on the transverse sleepers; the rail wear is very much less, vibration is deadened, and altogether the proposition is on many routes quite a practicable one. We have found that on water-bound macadam and tar-bound macadam they answer extremely well, and we can cover a large area of repairs in a very short time.

Mr. W. Thom (general manager and engineer, Potteries Electric Traction Company).—Mr. Spencer has referred to the construction of sleepers. We are all satisfied that there is nothing to beat transverse sleeper construction, but has it occurred to anyone to introduce Ferodo or some similar material between the wheel tyre and the centre? Mr. Humphries has covered the points I had intended to mention, and judging from what he said I think that as a "society of blacksmiths" we have done very well up to the present. But it is up to the manufacturers to carry out these experiments for us, and introduce what we require, with a few hints from ourselves. We have in the Potteries a couple-car unit such as might be used for dealing with peak loads. This is equipped with motor-driven air compressors, and runs very satisfactorily. We should be pleased to show it to anyone who cares to visit us.

Mr. E. H. Edwardes.—In thanking Mr. Spencer for his most interesting paper, I must say that it appeared to me when I read it that he was rather under the impression that because a thing was designed many years ago it was bad, and ought to be improved. I do not think that always follows. I remember some years ago examining some mechanical instruments in a museum in Naples. They were dug up at Pompeii, and so dated back for 2,000 years. It was extraordinary to see in some very common instruments that there had been practically no alteration since that time. I noticed a common pair of scissors. The scissors used in the days when Pompeii flourished were almost exactly the same as those used to-day. Because the scissors of to-day were designed 2,000 years ago, I do not see why they should be wrong. That reasoning is rather on a par with what has been said about some of the apparatus used on electric tramways. Personally I think that one of the great reasons for the enormous success of our poor old electric tramcar is the great genius which must have been brought to bear when certain parts of the equipment, especially the motors, were designed 20 or 30 years ago. When we remember that nearly all of us are using motors which have been in operation constantly for 20 years, it is truly extraordinary. I do hope we are not going to change them much. The same with the old trolley wheel. The trolley-wheel of to-day and the trolley-wheel of 25 years ago are very much the same, and I do not really know whether they can be improved. One apparatus Mr. Spencer has left out of account, namely, the gear case. Personally I do not use it. The gear case now costs rather more than a car wheel, and I find it cheaper to wear out the car wheel than to keep putting in a new gear case. Personally I think the design of the gear case an absolute disgrace. It has not been improved a bit. Think of the amount of care given to the designing of the gear box on motor cars while our old gear case on a tramcar is almost exactly the same as it was years ago.

Col. S. E. Smith (manager, Bristol Tramways and Carriage Company).—This paper might be regarded as a thorough condemnation of the tramways of this country; I do not think the case is quite so bad as Mr. Spencer makes out. Many improvements have been made, and there are many more which might be made in our present rolling stock; but I do not suppose that any of us are making such profits as to justify the adoption of an entirely new design of tramcar. I would like to mention a few points wherein trucks might be improved or ideas already under consideration might be further developed. I may say that we have experimented with two Peckham pendulum trucks, and while we consider that 8 ft. 6 in. is too great a wheel base on our system for a single truck—causing undue wear of wheels and track—the 7 ft. 6 in. wheel base is satisfactory and an improvement on the rigid type of truck. Brakes are very crude at present, and should be developed either on the lines of compressed air or hydraulic type brakes, operated with oil. The adoption of ball bearings is to my mind the most important thing to be carried out. At Bristol we put in a set of armature ball bearings just over nine months ago. Since then we have had no trouble at all with them, and they show practically no sign of wear. The old bearings one has to renew, as a rule, after something under three months, not on account of the wear of the bearing metal, but on account of the small gap between the armature and the pole pieces. With the use of ball bearings there is a very great saving in lubrication. As a simple demonstration of the efficiency of the ball bearing one may compare in an ordinary shed with very slight gradients a car fitted with ball bearings on the armatures with a car not so fitted. The latter will just move off down the shed, but the car with ball bearing armatures will acquire dangerous speed by the time it reaches the end of the shed. That is a very simple demonstration of the effect of ball bearings on the armature only. With regard to axles, I am not at all sure that ball bearings or roller bearings will be a success, owing to the shocks of impact, until our tracks are in very much better average condition than at present. With regard to gears, we were testing recently some renewable teeth-circles—not a bad idea, but rather heavy and cumbersome, and involving difficulty in taking them from the axles.

With regard to the electrical equipment, a very simple improvement, for anyone who still has the G.E. 800 motors, is to re-wind as a 4-turn armature, thus bringing it up to the efficiency of the G.E. 58 motor, and increasing the speed. With regard to brakes, there are very few systems in the country which use their rheostatic brakes in service. We have always done so, and quite satisfactorily. This cannot be done as the brakes are usually installed, and we had to carry out a good deal of experiment to get the correct relation between power and braking. But having done this, it proves quite a satisfactory brake, and I am sure our repairs are rather less than the average. With regard to collector gear, we have been experimenting with shoes, and they are satisfactory in some respects, but from the traces of the metal on the shoe it is obvious that the wear on the overhead equipment is excessive, and we have not yet got the right metal. With regard to noise, Mr. Spencer suggests that we ought to apply ourselves to doing away with it. I have no objection to noise as such, but noise is simply the audible expression of wear and tear, and therefore we must get our cars to run on concrete tracks without noise, so proving that we have succeeded in improving our equipment very greatly.

Mr. R. G. Cunliffe.—I welcome this paper because of the opportunity it affords for discussion, though the tone is rather pessimistic. Quite a number of improvements have been made recently—during the past five years—and are now available. The figure of 70 lb. per H.P. that Mr. Spencer gives is scarcely applicable to-day to the latest designs. I know for a fact that there are motors running now approximating to half of these weights—between 30 and 40 lb. per H.P. That includes all the accessories—gears, gear cases, suspension bearings, etc. There have also been improvements in recent designs in the rate of acceleration, and not only that, but in the length of time during which acceleration is maintained. One way of increasing the average speed without increasing the maximum speed is to maintain acceleration longer—what the designers call "striking the curve later," and at a higher speed. The question of shunt motors is not a new one; it is quite an old question. The failure of the shunt motor in days gone by was due to the flat curve. The starting qualities of a shunt motor are bad, the running qualities are good. The ideal would be to have the starting characteristics of a series motor and the running characteristics of a shunt motor. Attempts are being made to approximate in that direction, particularly in the trackless design. Mr. Spencer refers to contactor control. I had the pleasure of demonstrating contactor control to him a month ago, in service. The thing is very simple and compact, and will carry out all operations hitherto carried out. There have also been great improvements in roller bearings. I have been connected with this question on a very large scale. We have had experience during the past two years of five types of roller bearings, all on motor armatures, and in four cases out of the five with exceptionally good results. There are roller bearings standardised now that will have a life running into many years, and I could mention cases in this country where roller bearings have been opened up at four months' intervals for eighteen months, and are still reported in condition as good as new. They save maintenance costs; you only need to lubricate once in seven months. The grease is squirted in; there is no handling of oil. The grease is put in, not as a lubricant, but to keep the roller clean. The absence of friction is almost complete, and the grease maintains a clean condition and prevents oxidisation. The number of roller bearings in this country in actual use at present runs into something over 400, although that is not generally known, and the number of inquiries for roller bearings from tramway managers is an indication of the very wide interest taken in the subject. Another advantage of the bearing is that in the case of seizure, which is very rare, there is no contact of the armature with the pole. In the rare failure of a roller bearing, there is no risk of the armature coming down on the pole.

Another direction in which a great amount of money has been spent in research is with regard to this question of the heat treatment of steels. There is a great deal more going on in the laboratories of the steel manufacturers than is published at present, particularly in the examination of the possibilities of heat-treated steels; chiefly for gears, but also for axles, wheels, and various parts of car bodies, with the object of lightening the weights, with obvious reduction of strain.

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Mr. Edward Baker (John Baker and Company (Rotherham), Limited).—I think that people have a wrong idea on the subject of alloy steels. I do not believe they thoroughly understand the properties of these steels. One very important point is that the elasticity of all steels is practically identical. If you have a 4 in. axle, whatever steel you use, it is improved if when loaded it will deflect a certain amount. Another question is that of wheel centres. Mr. Norton is rather behind the times when he speaks of the wood centre. The wood centre has been tried, and it is found that the heating of the tyre and the heavy braking destroy the properties of the wood, and these wood centres have now practically been displaced by steel.

Mr. H. W. Laing (manager, St. Anne's Council Tramways).—I have got roller bearings on the axle, and have been driving them for months, with very satisfactory results. During last year the current consumption was 0·9. I put roller bearings on the axles, and the car went so easily that it could be pushed by one man, and the current consumption on those cars has come down to about 0·65. Just before I left home I had them examined, and they were practically as good as new.

Mr. A. W. A. Chivers.—I feel that I can sincerely thank Mr. Spencer for having brought this paper before us. When I read the paper, and knowing that Mr. Spencer was very well acquainted with much of the progress that has been made in connection with tramcar design, I felt that his whole object in bringing this paper before us was to increase our interest and enthusiasm so that we may do still better, and I think a paper of this character is good for us all. It is an incentive to get out of the ordinary rut. I think, too, that the paper is brought before us at an opportune time, especially in those caess where rolling stock may be getting near the end of its useful life, and will need to be replaced by new cars. In such cases it is good to have the most modern practice brought before us, and particularly the directions in which further improvements may be effected. From that point of view I think we are much indebted to Mr. Spencer for his paper. Many interesting points have been touched upon, but there are one or two others which may be of further interest to members. Mr. Spencer has referred to the regenerative control which was introduced by the late Mr. Raworth. In case there may be some misapprehension as to the type of motor Mr. Raworth employed, let me say as one who was fairly intimately associated with the development of that system in its earlier stages that it was not a shunt wound motor, but a separately excited motor which was employed. With such a motor, which had a somewhat different characteristic to the shunt wound motor, results were obtained which could not have been attained by the ordinary shunt motor. In connection with the control of that regenerative system, so far as the operation was concerned it was almost ideal. The type of controller Mr. Raworth employed was simplicity itself and called merely for the controller handle to be moved forwards or backwards, according as to whether the speed was to be increased or decreased. A large saving was effected in the cost of maintenance of brakes, the regenerative effects brought the car to a stop and the brakes were used only to keep the car at a standstill, but, as Mr. Spencer points out, I think Mr. Raworth was a little before his time. With developments which have since taken place in motor designs, I feel that regenerative control is worthy of much consideration.

With regard to collector gear, we have been carrying out some experiments with the sliding collector in place of the trolley wheel. In this connection we fitted the whole of our cars on one system with sliding collectors. From an operating point of view they were found to be satisfactory, but the wear on the trolley wire was found to be rather excessive. The wear was very much more severe on curves than on the straight, so that on a winding route the results would not be as good as on a straight run. With the collector we used a tension of about 28 lb. as against 22 to 24 with the trolley-wheel. Perhaps I might mention some experience we had with the sliding bow. The only tramway system working in this country with a sliding bow was at Sheerness. It was the Siemens' system, commonly used on the Continent, not particularly beautiful to look at, but certainly very efficient. Its use simplifies the construction and reduces the cost of the overhead work, and if the trolley wires are staggered, so that the wear takes place evenly along the whole length of the bow, the results are good. The cost of the upkeep of the bow was slightly in excess of the trolley wheel. The bow consisted of an aluminium strip, U-shaped, the "U" being filled with a lubricant, and from all practical operating points of view it was satisfactory. There is certainly very much to be said in favour of it as against the trolley wheel. The system is in common use on the Continent, and is similar to that used on the London, Brighton and South Coast Railway Company's electrified lines.

Just a word on roller bearings. It is nearly twenty years ago that we started an undertaking at Southport, and the whole of the cars on that undertaking were fitted with roller axle bearings. They continued to run up to the day when the undertaking was handed over to the Corporation, and so far as I know are still in use. At first they were not altogether satisfactory. Ultimately we got over the troubles fairly well, when the results were excellent. One man could push the car, the resistance was so small, and I believe that the current consumption on that system was about the lowest in the country. It was under 0·6 units per car-mile for a period of many years.

Mr. A. G. Conway (Wood-Gilbert Rail Remodelling Company, Limited).—There has been very little discussion on the question of noise. It is not a matter of small importance. So far as industrial districts are concerned certainly there are very few complaints; but in the outlying districts and the better residential quarters complaints as to noise are apt to be pretty frequent. Are we looking in the right direction when we say that we require a lighter car in order to be able to eliminate that noise? I have recently had opportunities of studying some types of cars in use on the Continent, primarily the question of corrugation, but incidentally the question of noise, and it was then my experience that with the lighter car the greater was the prevalence of corrugation, but with a heavier car with low centre of gravity the less was the prevalence of corrugation. Noise has, of course, followed corrugation. In the case referred to on the Continent, a single-deck car with centre entrance is in use, each of them capable of seating 96 pasengers, and is running very quietly. I went over a whole section of the track on which these are used in March last, and found no sign of corrugation; yet in the same town, operating under similar conditions but with lighter ordinary single-deck cars, corrugations appeared. Now corrugations are the primary cause of noise, certainly after the cars have been running for some little time; therefore is it not a matter of looking to a heavier car with a lower centre of gravity which will tend to prevent wheel slipping, rather than to a lighter car? These particular cars, although constructed to carry 96 passengers, are quickly filled and emptied. The same type of car if used in this country would be of great use. Certainly in congested areas we do not require a car which will carry more than 96 passengers of the centre entrance type, although it has its advantages. It would be a very great improvement over the existing type of double-deck car.

Mr. R. Ainsworth (Manchester Armature Repair Company, Limited).—Mr. Spencer tells me that designs of a motor as low as 20 lb. per H.P. output have recently been considered by his companies. The question of speed, of course, enters into that, and I should be glad if he would give us a little more information on that point. Mr. Spencer also makes allusion to the use of aluminium in the construction of cars. I think we shall have more of that than in the past, and it will be a very effective means of reducing weight. It has often been used in the construction of motors, the coils being wound with aluminium instead of copper. That, of course, means only a small reduction of weight, but it is promising.

Mr. W. V. Morland (engineer and manager, Notts and Derbyshire Tramways Company, Limited).—I particularly wish to thank Mr. Spencer for giving the account of his experiments with the one-man car. I have followed this with very great interest, and was hoping that in the discussion which followed the representative of the British Electric Traction Company would also favour us with some remarks on the subject. I recall the fact that many years ago they placed a one-man car in service on their Southport tramway system. After being in commission for some time it seemed suddenly to disappear, and I often wondered what happened. One speaker suggested that a ferodo or similar fabric might be used with good results as a rail packing. A few years ago we tried a $\frac{7}{8}$ in. rope packing on a length of track. The rope was beaten in under the rail on the top of the original concrete bed, after being smeared with a specially prepared mixture something akin to a thin oily putty. The moment the cars run on the packed rail the difference is apparent. There is much less noise, and no corrugations have ever appeared. This particular length of track has cost us very little in maintenance. Whilst labour charges are so high, I am afraid that the cost would be too prohibitive to allow of any further lengths of track being similarly treated. The remarks about the improvements effected in truck design, jazzing, tail wagging, and also the reference to the Peckham pendulum truck held a particular interest for me. We have had a large number of these trucks (with an 8 ft. wheel base) in commission for about seven years. The pendulum gear costs more to maintain than the older type of truck, but there is a great saving of check wear on curves, and no "wearing off" of wheel flanges. I must say that I have been rather astonished with the results, and we have never been troubled with any jazzing or tail wagging on these cars.

Mr. R. J. Howley.—Mr. Spencer's is a very clever and interesting paper. He has headed it "Modern Improvements in Rolling Stock." He might have put as a prefix to the title the words "Want of." He goes on to indicate three lines on which the question should be considered. He asks—Was the design of tramcars 25 years ago so perfect that nothing further can be done in the way

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of improvements? Is there some insurmountable obstacle to radical improvement? Is the tramcar a thing of the past, and is a rubber-tyred vehicle as compared with a rail-borne vehicle so greatly superior for street transport purposes that it is a waste of time to further develop the rail-borne variety? Now it seems to me that these are very silly questions to bring before a meeting like this. The answer to the first two is obvious, and I think it is almost an insult to this meeting of tramway managers to bring forward the third. I think the progress of passenger transportation is on the lines that where you have got a heavy mass which necessitates going over the road with a heavy vehicle or a number of moderately heavy vehicles, it is fully justifiable to lay a railed road, but where you come to single-line tramways, working routes where the traffic is light, it will be difficult, I think, in the future to show that the tramway is the right form of transportation, especially if the cost of the motor omnibus is reduced. To-day, I think, as regards cost, that there is a very large difference in favour of tramways, but if the cost of petrol is reduced that difference will to some extent disappear.

Now, sir, I am very sympathetic with the speakers who have said that we have not sufficiently considered the question of noise. The question of noise is a most important one, and must be taken into full consideration. A great deal can be done towards its elimination by paying regard to the type, form, construction, and maintenance of the car. If our tramway cars were as carefully designed and as carefully maintained as the ordinary motor omnibus chassis the noise would be reduced to a very great extent. To see the rough and ready way in which the tramway track is maintained grates upon an engineer. You see the sector plates in the car put in without any machinery of any kind; you see the axle box fitting with a slackness which is bound to cause noise and wear, and you have wheels and pinions which are not very efficiently meshed, and which, as wear goes on, are bound to get noisy. The proper way of starting afresh would be to start with a tramway track built in proper engineering style, and maintained in the same way as an omnibus chassis. With regard to types of car, I think that in the case of the London County Council the limit has pretty well been reached. The troubles which the London County Council has been having with rails and tyres almost point to the fact that the limit has been overstepped, and that further carrying capacity will have to be developed by length rather than by height. In future we shall be more accustomed to running trains of cars where the service is heavy and the traffic necessitates it. I am greatly interested in the question of brakes, because I think a great deal of our difficulty in maintaining a high average speed will be solved when we have a more efficient braking system. Last autumn, in Vienna, I noticed that the whole of the service was done on the rheostat brake, and very efficiently done too; and if we can get a motor which is going to stand up to that work, there is no doubt that it will prove the most efficient way. I think that Mr. Spencer has a hydraulic or liquid brake of some sort in use, but these all necessitate a great many parts and pipes, and are not always very quick in operation; there is some amount of time lag, certainly in the case of the air brake. Reference has been made to the "pay-as-you-enter" car. The reason why that has not been successful in this country is a physical one in regard to the car. We have not got the big platforms they have in America, and on our platforms we cannot have people standing about and awaiting their turn as they do in the United States.

I welcome the proposal to use ball bearings over the armature shafts. The ball bearing is eminently suitable for such a purpose; and, of course, the ball and roller bearings are very different now from what they were 10 or 15 years ago. It is interesting to notice that Mr. Spencer apparently was an inventor as far back as 1888, when he provided the Blackpool cars with brushes. He says, "to which system I had some attachment." He does not say what the attachment was, but I think Mr. Spencer must have been in short trousers at that time.

Now, sir, this paper points out a large number of matters which require improvement, but looking at the question from a bigger aspect, one sees a difficulty at once. If all the suggestions set out in this paper were to be adopted it would mean that the tramcar would be put on the scrap heap, and that we must start again. Financially that is impossible. At the same time, if the tramcar is to hold its own in competition with other forms of transport it has got to be improved, and I myself think that capital spent in improvements, many of which have been outlined to-day, would be money well spent, and that the return would be considerably higher than the average return has been in the past. There is another matter which relates more to the companies than to the municipalities, namely, the difficulty of undertaking improvements where there is short security of tenure. Most of the tramway companies are working their undertakings now beyond the 21 years which was their original tenure, and they are subject to seven-year purchase from varying dates. It is impossible for a company to put down any large amount of capital when it does not know whether within the next seven years its undertaking may not be purchased on conditions which would not permit of any claim being made for the capital recently spent. But I think the whole of what Mr. Spencer says in his paper rather points to a new field of activity for this Association, perhaps working in co-operation with our municipal friends. I think we should do well to set up an engineering committee or committees—for the subject might have to be divided up among a number—which would go more closely into these various matters, and would perhaps be able to circulate for the use of members information which would be of great value. Mr. Spencer has visited the United States, and some of his recent ideas show the influence of that visit. I think probably he would have acquired more information if he had toured this country and studied our failures. There is one point in passing about the one-man car. At the time when the one-man car was being worked at Southport and Barnsley the wages of the car staff were not nearly as high as they are to-day. The one-man car was an exceedingly useful car to work—when there was no traffic. But it was really of no use when full loads had to be dealt with. It is too much for the ordinary driver when he has to deal with 20 to 25 passengers. He has got enough to do at his own job. But to-day, in view of the high wages of conductors, it may again be justified, and it may be possible to obtain drivers for this purpose, assisted by such cash-receiving and change-giving devices as we have seen to-day, and they may be able to deal even with moderately heavy traffic.

Mr. A. H. Walton.—Mr. Spencer's paper must certainly take credit for having set us all thinking. When I read this paper first—I am speaking as a member of a manufacturing firm and not as a representative of three or four tramway companies—I rather felt Mr. Spencer was doing here what he does in town—stirring people up. He tells us of a motor of 20 or 25 lb. weight per H.P. output. I have a shrewd idea that the motor he speaks of derives its power from a generator driven by an internal combustion engine. The motor frame is of steel, and is only sufficiently wide to accommodate the poles, and the two heads of the motor are aluminium. To my mind such a motor cannot be compared with a tramway motor such as is required for tramway work, and we are called upon to build, to take up the stresses of overload in ordinary tramway work. The motor which Mr. Spencer speaks of cannot be asked to give any overload, because there is no excess power in the engine to give it. With our tramway motors we are far in advance of the motor which Mr. Spencer puts before us as an example, because we have a motor which will give a good overload as against a motor which will not give it. Then as to regeneration control, I remember that this was tried on the Scarborough lines, and the utmost saving they got in those days was about 10 per cent.—a gentleman behind me has mentioned 12. Mr. Raworth tried this system on all and sundry, including motors unsuitable for the work. So far as manufacturers are concerned, we welcome these papers, as we like to get their views. I would add that there has been a great amount of money spent in investigating these problems, and further, we with others are doing our best to improve matters. The shunt motor characteristic was also investigated many years ago, and from what Mr. Spencer tells us this is a problem which is being looked into very carefully. I congratulate Mr. Spencer on what he has done to stimulate and stir us all up.

Mr. A. W. A. Chivers.—May I be allowed to intervene for one moment in view of the remarks of the last speaker? The amount of saving by the use of regenerative control depends almost entirely on the gradient of the line. If regenerative control is applied to a moderately flat route you cannot get much regeneration, but on a hilly route very considerable saving can be effected. Mr. Spencer's figure of 20 to 25 per cent. refers, I think, to a fairly hilly system.

Mr. C. J. Spencer, in replying on the discussion upon his paper, said—Mr. Chairman and gentlemen, I feel very gratified by the reception of this paper. I have tried to be frank, but I hope I have not been insulting. At any rate, what might be impertinence on the part of an outsider is merely a friendly talk on the part of a olleague. Like yourselves, I have been responsible for operating tramways for a good number of years, and whatever criticisms I have made apply just as much to myself as to anyone in this room, so that I do not want any member to take umbrage because a colleague has perhaps spoken a little frankly.

Many interesting points have been raised, and although the hour is well advanced, I propose to ask your indulgence while I deal with them briefly. To deal with the last question first, that of regenerative control, Mr. Howley suggested that it must have been just a short test that I made. As a matter of fact, it was a test extending over three months with two ordinary cars on ordinary daily service. As Mr. Chivers has rightly surmised, it was a test on a very hilly route, the average gradient being 1 in 14, so that there we probably got the maximum. That explains what may probably have been a little difficult in my paper. One member

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was good enough to say that this paper had set us all thinking. That was its object. It is perhaps deliberately a little extreme, but I would rather seek after a high ideal and fail in the pursuit of it than acquiesce straight away in a low one. The motor I referred to is supplied from a generator which in turn receives its power from an internal combustion engine. I was very glad to hear that, notwithstanding all the difficulties, the firm which one speaker represents has produced a motor with exactly the same characteristics. The motor is there in being, and this in itself denotes a great advance upon what we had before.

Mr. Howley, while apparently starting out to disagree with all that I said—and knowing Mr. Howley so well as I do, and being on terms of friendship with him, I can quite understand his point of view—ended by suggesting that he was thoroughly in agreement with me. I noticed that Mr. Howley did not take exception to all that I said about crudities of design and workmanship. He tells us how necessary it is to get away from the blacksmith's way of doing things, and urges us to follow the example of our great rival, the omnibus engineer. Mr. Howley is not against my position at all; he is really in favour of all that I have said. Mr. Howley also referred to brakes. If there is one subject in tramway management that I have specialised upon it is brakes, and I may be a little cranky, but I believe there is a great deal to be said for the air brake. Somebody was good enough to mention the hydraulic brake, but the hydraulic brake to which my name is attached is an air brake; the hydraulic part of it is simply the transmission medium, and I am very sorry to find that the makers of this brake, whilst sending it down to Bournemouth, dumped it down at the depot and left it there. I do not understand why it has been dumped down in that haphazard way, but there it is. I am also very sympathetic with the remarks about the rheostat brake. There is a great deal to be said for this brake, though most of us in turn have condemned it. But it is fundamentally sound, and there may be a future even for he old rheostat brake.

With what has been said about " pay-as-you-enter " systems and the large platform I am in agreement. To get success one must have a big platform, and a single-end car or even a centre entrance may be very desirable. I am able to show you after this discussion is over the apparatus of the Shanklin Transfer Ticket Company in the shape of a ticket-issuing machine, and also a coin-changing machine and fare box, and a representative of the company will be here to give a demonstration.

Mr. Howley thought I must have been an infant when I put carbon brushes on to commutators. It is true that I was not very old. I was an apprentice, and my first job was to rivet little brass nibs on a steel plate to be used as a copper commutator. It was a most monotonous and soul-killing job. Then a bright idea struck me to try carbon, with the result that our troubles vanished, and, so far as I know, that was the first time carbons were used for electric motors. I remember that the directors gave me a sovereign. Mr. Morland spoke of the one-man car. We are experimenting in London now with a one-man car, to some extent on American lines. Anyone who cares to visit us in order to see it will be welcome. Our troubles have gone one by one until to-day we have a very workable proposition. The only fundamental difficulty outstanding is that of handling passengers quickly enough. Where the traffic is very thin—not exactly where there is *no* traffic, as one speaker said—I believe there is something to be said for the one-man car. At any rate our experience up to date has been satisfactory.

Mr. Ainsworth asked as to the speed of the motors. The ordinary tramway motor has a speed of 500 or 600; these lighter motors have a speed of 1,000 or 1,500. It is largely a question of gear.

Mr. Conway spoke about single-deck vehicles and corrugation. We have investigated corrugation from every possible angle, and at various times we have thought that we had found the real cause. If it be thought that the single-deck car eliminates corrugation, it is awkward to find corrugations occurring in some places where single-deck cars are solely used, and the same holds good with the heavy car. All these supposed causes of corrugation may be found to be contradicted by experience. I suggest that with single-deck and light cars corrugation may be quite as bad as with others.

I am exceedingly grateful for the remarks of Mr. Chivers. Mr. Laing spoke of roller bearings and current consumption. We tried roller bearings twenty-five years ago, and they were not then a success, but the roller bearing of twenty-five years ago and the roller bearing of to-day are different things.

Mr. Baker said that these different alloy steels are not quite so miraculous from some points of view as the outsider might think. That is interesting; but still I do know this, that some of these modern steels—for example, nickel steel, which is not very modern really—give much better results for axle work, and result in much longer life. How that is I do not know; I am not a steel man, but we cannot shut our eyes to experience.

Mr. Cunliffe said he thought my paper was pessimistic; that it had a pessimistic tone. I do not think so at all. If you read it properly you will find that it is not pessimistic. It is intended to be optimistic. It might have been pessimistic if, like Mr. Edwardes, I had gone back to Pompeii. I am reminded by what he has said of the man who found some copper wire in the ruins of Pompeii, and deduced from this that the Pompeiians had telephones, whereupon another man went further and said he deduced wireless telegraphy because he found nothing at all. I understand that the representative of the Peckham Truck and Engineering Company has a model of a Pendulum truck here which he thinks ought to be mentioned, and I believe it is worth looking at from the point of view of stopping " jazz," in view of the interesting information we have received from Colonel Smith, of Bristol, and Mr. Morland, of the Notts and Derby Tramways. Colonel Smith thought my remarks a condemnation of tramway managers, but, of course, it has to be remembered that there are financial difficulties in the way of tramway managers carrying out improvements. Mr. Howley rightly pointed out the difficulty of throwing all our cars on the scrap heap and buying new ones. It is a great difficulty, but after all, we exist as an association, and I think that this Association in conjunction with other associations of a similar character, might consider whether the pioneer work, which should not rest upon just a few shoulders, cannot be spread among a larger number.

With regard to ball bearings for armatures, I tried ball bearings for armatures ten years ago, with very good results. Even then ball bearings were not what they are to-day. On the other hand, in America I found opinions about evenly balanced between ball and plain bearings.

With regard to Mr. Humphries' remarks, I was rather " sitting up " for him, in view of what he suggested yesterday, but I find, to my surprise, that he is quite in agreement with all that I have said. He agrees with nearly every one of my comments. He asks me to contrast the old Darlaston stock with the latest London County Council car. I do so, and that is my trouble. I notice that on some of the London County Council cars the handle turns round and the starting is done in exactly the same way as on the old Staffordshire car. The principle is just the same.

Mr. Humphries.—Most principles are, Mr. Spencer.

Mr. Spencer.—But the purpose is also the same. He himself says that he sees the lines of the old horse vehicle in the modern tramway car. I do not see this tremendous improvement between the London County Council stock and the stock of the old South Staffordshire Company, which are now enjoying a well-earned rest in the fields of the Black Country. The single-end car, as Mr. Humphries suggests, is worthy of a good deal of thought. The rolling stock man is inclined to remove the thing from his mind because it involves something being done to the permanent way. The need is for a meeting between all the departments concerned.

Mr. Edwards mentioned the question of unsprung weight. I could never understand the reason for the abandonment of the motor that he mentions, but again it was the old story—it was not seen that the development of the heavy motor would come along. On the question of wheel diameters, I have been recently in Edinburgh, where I was very much impressed by Mr. Pilcher's experiments with a very light, small, flat motor and a small driving wheel. It is too early to say whether it is good or bad, but Mr. Pilcher has gone quite in the opposite direction with a small motor and a steel wheel, without tyre, which enables him to get a high-speed motor and a light motor, and I think we may watch the experience of Edinburgh with much interest.

Mr. Norton spoke of the desirability of standardisation. We have had too much standardisation in a way, and though I, of course, agree generally with regard to the absurdity of having many different sizes and weights, the trouble to-day is that as soon as we settle on a design we have so many formalities to get through that before the thing is published and really in being it is out of date. There is something wrong with our procedure in these matters, and we might perhaps improve our machinery for dealing with them. I think I have traversed the whole of the ground, and it only remains for me to thank you for your kindness and tolerance.

The Chairman.—It only remains for me to express the thanks of the members to Mr. Spencer, and to assure him of the pleasure with which we have listened to his paper, and how much we thank him for the ideas he has brought forward.

The vote of thanks was accorded by acclamation, and the ticket-issuing machines and coin-changing machines were then demonstrated, together with the model of the Peckham patented pendulum truck to which Mr. Spencer had referred.

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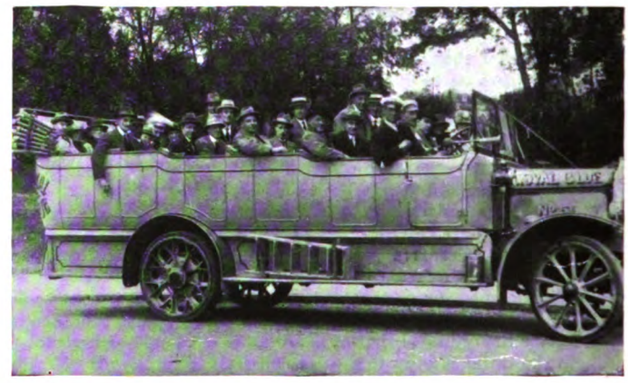
THE ANNUAL MEMBERS' DINNER.

On Friday evening the annual members' dinner took place at the Norfolk Hotel. Sir Arthur Stanley, president of the Association, was in the chair, and the Mayor of Bournemouth and other members of the Bournemouth Corporation were among the guests of the Association. The members, many of whom were accompanied by ladies, included the following—

R. Ainsworth	H. England	W. Moscrip
R. H. Aspinwall	E. H. Fleming	E. M. Munro
Edward Baker	W. E. Freir	A. Norton
E. Barralet	A. T. George	P. Pearce
P. R. Blake	W. E. Hardy	L. Rowell
A. G. Bird	L. E. Harvey	C. P. Sandberg
H. Bond	W. H. Hawley	F. E. Saunders
F. Bourne	D. Hays	H. Scholey
—. Bradley	H. Hellewell	W. H. Shaw
Ald. H. Brown, J.P.	F. Hewer	A. E. Shorter

The "Trackless" Front Drive Omnibus.

A Demonstration of the Sandberg "*in situ*" Process.



Tramway Men find Motor Coaches useful—even at a Tramway Congress.
Snapshots at the Bournemouth Congress.

C. L. Buckley	L. B. Hewitt	Ald. R. A. Smithson
W. H. Buckley	J. S. Hamilton	W. Alderson Smith
I. Bulfin	A. R. Hoare	W. G. Verdon Smith
C. D. Burnet	A. J. Hollington	Col. S. E. Smith
J. M. Cater	H. Holliday	W. K. Spark
J. M. Calder	R. B. Holt	C. J. Spencer
G. W. Chalmers	R. J. Howley	Hon. Sir A. Stanley, G.B.E., M.V.O.
A. W. A. Chivers	Richard Humphries	W. A. Stevens
R. Chisnall	W. E. Ireland	A. W. J. Talbot
A. G. Conway	A. H. Jackson	C. R. Tattam
H. Cooper	C. J. Jewell	C. G. Tegetmeier
F. Coutts	J. J. Kelly	W. Thom
R. Coutts, Jun.	Douglas Kerr	S. Thomas
G. F. Craven	C. Y. Knight	A. Toms
R. G. Cunliffe	H. W. Laing	H. E. Townell
C. E. Cyphers	E. H. Lean	H. J. Troughton
E. E. Daglish	C. Leigh	W. H. Turner
W. D. Dawes	Stephen Loosen	A. H. Walton
W. T. Dawson	C. Lucas	A. M. Willcox
A. de Turckheim	G. A. May	A. M. Willis
A. Dimmack	W. V. Morland	A. E. Wray
W. V. Edwards	A. J. Moore	
E. H. Edwardes		

TRAMWAY EMPLOYEES' WAGES.

NOTICE TO TERMINATE JUNE 1921 AGREEMENT.

The existing agreement in regard to tramway employees' wages is to be terminated. The following communication, signed by Messrs. J. Beckett and A. de Turckheim, joint secretaries of the employers' side of the National Joint Industrial Council for the tramway industry, was issued on June 21, giving three months' notice to terminate the existing agreement—

"We beg to inform you that the representatives of both sections of the employers upon the National Council have been giving consideration to the existing relation of tramway wages to similar classes of labour and to skilled, semi-skilled, and unskilled labour in other industries, and as a result they have come to the conclusion that the existing position is such that full reconsideration is required of the whole question by the National Council.

"We are therefore directed to tender to you three months' notice to terminate the agreement entered into on June 16, 1921.

"Will you, as the acting secretary of the National Council for the time being, be good enough to place the matter on the agenda for the next meeting, to be held on July 13, 1922?—Yours faithfully, J. Beckett, A. de Turckheim, Joint Secretaries for the Employers' Side."

In acknowledging the receipt of the notice, Mr. John Cliff, acting secretary of the employees' side of the National Joint Industrial Council, says that the question of the operation of the notice involves an important point of procedure. It appears to him that as the agreement referred to was made by the National Council, a notice to terminate the agreement must be formally received by the National Council when in session, and can only be operative from the date of the meeting when such notice is formally received. The decision of the Council on the matter will be taken at their next meeting on July 13.

The agreement of June 16, 1921 (which was published in full in our issue of July 14 last year), stipulated that the then existing rate of wages should be maintained until the commencement of the first full pay period in August 1921. It further provided that thereafter reductions from, or additions to, wages should be made every three months at the rate of 1s. per week for each complete five points' variation either way in the cost of living index figures issued by the Ministry of Labour. Alterations in the rate of wages of youths

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under 18 years of age would be similarly regulated, with the exception that the amount of deduction or increase would be at the rate of 6d. per week.

RAILLESS DEMONSTRATION AT DOVER.

On Thursday and Friday, July 6 and 7, Railless, Limited, of Moorgate Street, London, E.C., gave a demonstration at Dover of one of their new type single motor railless cars. The machine was one just completed for Ramsbottom Council, and by the courtesy of the committee and the general manager, Mr. S. Parsons, the vehicle was brought to Dover for inspection by the members of the Dover Tramways Committee. A number of engineers and managers from various undertakings which are contemplating the introduction of railless traction were also present, and it was the general opinion that the running of the car was thoroughly successful. It was tested on very steep gradients, and on a stretch of 1 in 10 the car was stopped and started with remarkable ease. The efficiency of the brakes was particularly noted. The car is of the single deck type, and is provided with a roomy compartment for the driver, which at Ramsbottom is also to be used for the conveyance of parcels. The springing of the vehicle is very satisfactory, and passengers found the riding very comfortable. The seats are provided with cushions and high backs, and every effort seems to have been made to make the riding as agreeable as possible. Dover was one of the first municipalities to construct electric tramways in this country, and the first lines were opened in 1897. Owing to local conditions, the tramways have had a somewhat chequered history, and under post-war conditions they are in a position of some difficulty. Certain portions of the permanent way will shortly require renewal, and Mr. E. H. Bond, the manager, is in favour of substituting railless cars. It is probable that the Council will decide to follow this course instead of incurring the heavy cost of tramway renewal, as there is no doubt that the railless cars will be capable of giving all the service required.

Railless Demonstration at Dover—Omnibus constructed by Railless, Ltd., for Ramsbottom Corporation

MUNICIPAL TRAMWAYS ASSOCIATION

The Managers' Section of the Municipal Tramways Association met at the City Chambers, Glasgow, on Thursday morning, June 13, when Bailie M'Whirr welcomed the delegates, of whom about 50 were present. Treasurer Kelly and Bailie Izett also joined in the welcome. Mr. J. B. Hamilton, of Leeds, thanked the Corporation for their welcome, and said that by the example set by Glasgow in 1894 the whole history of municipal enterprise had been very much altered. Mr. Alex. Gerrard, works manager of the Glasgow Corporation Tramways, spoke on the maintenance of rolling stock. The delegates were entertained to luncheon at the City Chambers, and in the afternoon a visit was paid to Coplawhill tramway works. The delegates later went to Aberfoyle, where they dined. The conference was resumed on the following day, when Mr. R. Beattie, manager, claims and legal department of Manchester City Tramways, discussed the prevention of accidents.

EDINBURGH ELECTRIC TRAMWAYS.

FIRST CONVERTED ROUTE IN OPERATION.

The first route of Edinburgh Corporation Tramways to be converted from the cable system to overhead electric traction was put into operation on Tuesday, June 20, with appropriate ceremony. The line which was opened was that from Pilrig to Nether-Liberton, and the first car was driven by Lord Provost Hutchison. A large party of members and officials of the Corporation and invited guests were conveyed shortly before noon in municipal omnibuses to the new tramway depot at Leith, where the recently built electric cars were inspected. The vehicles had been gaily decorated for the occasion. The official party included Lord Provost Hutchison and Mrs. Hutchison, Councillor C. J. Mancor (convener of the Tramways Committee), many members of the committee and of the Town Council, Mr. R. Stuart Pilcher (general manager of the Corporation Tramways), the Town Clerk, the Chief Constable, Sir Robert Cranston, Sir George M'Crae, Mr. Manclark (Moderator of the High Constables), and several other municipal officials. Among the invited guests were the Convener of Aberdeen Tramways Committee (Councillor D. W. Beaton), and the general manager (Mr. W. Forbes), the Convener of Dundee Tramways Committee (Mr. J. G. Fraser), and the general manager (Mr. W. T. Young), the manager of Musselburgh Electric Traction Company (Mr. H. C. Babb), and representatives of private firms, including Mr. McArthur and Mr. Cunliffe, of the Metropolitan-Vickers Electrical Company, Mr. S. Thomas, managing director of the Peckham Truck and Engineering Company, and Mr. Menzies, of the North British Steel Foundry.

The Lord Provost took his place at the controller of the first official car, switched on the current, and, amid the cheers of the gathering, drove the car out of the depot. At Pilrig a dense crowd of people gave the car and the party on board a cordial welcome, and the vehicle broke a broad blue ribbon which had been stretched across the roadway. Souvenir tickets were punched by the conductor and handed to each councillor and guest. At Nicolson Street the successful progress of the car was marred by the behaviour of a body of medical students who boarded the vehicle—even to the roof—and boisterously assailed the whole party with bags of flour. The intruders were later forcibly removed by the police.

At a subsequent luncheon in the City Chambers, Sir George M'Crae proposed "Success to the Tramway Undertaking." He repudiated the criticism that by embarking on large capital expenditure for tramways they were damaging the financial reputation of the city. In his opinion it was entirely the other way. He congratulated Councillor Mancor on the enthusiasm, energy, and industry he had brought to his task.

Councillor Mancor gave an interesting survey of the position of the city tramways, and said they were that day celebrating the jubilee of their undertaking, as it was a little over 50 years since the first car was introduced in Edinburgh. Referring to the first

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instalment of the electric car system, he said he had always maintained it was the most economical and efficient method of transport known to modern engineering. Edinburgh was the first city in Scotland to adopt the high speed type of motor. As a result of experiments with this motor in Leith, combined with lighter equipment, they were not going to use nearly as much current as they originally thought necessary.

Alluding to fares, Councillor Mancor said out of every penny they collected in fares, at least a halfpenny went in wages. That would give them an indication of how much their hands were tied when they were asked that fares should come down to pre-war level. They would certainly never under any condition tolerate the tramways going on the rates. They must be made to pay, and they must have fares that would assure that the two sides of the account would balance. Councillor Mancor handed a silver model of an electric car, the gift of the Corporation, to the Lord Provost.

In proposing the health of the tramways manager, Lord Provost Hutchison described Mr. Pilcher as a loyal, diligent, and very active servant of the Corporation, who had carried on often in the face of considerable difficulty. He had now embarked on a new system, and they were sure he would make it a success.

MR. PILCHER'S OPTIMISM.

Mr. Pilcher, in reply, said it had frequently been declared that the expenditure of three-quarters of a million would ruin the tramway undertaking. The expense of running an electric system was, however, so much less than that of a cable system that they would doubtless be able to reduce working expenses. The difference in operation between an electric and cable system at the present time was 5d. a mile, and he had no doubt that in the first month that fivepence of difference would be clearly shown. The Council might have every confidence in going on with the electrification. The estimates for the conversion were put forward at a time when prices were very high. The cost of equipment was now down £500 per car, which represented on the present system a reduction of £117,000. He thought the town was not unfortunate in the time of electrifying the tramways, because they had been able to introduce equipment not possible a few years ago. There was no doubt that that new equipment would be the means of greatly reducing the expenses, and he had no doubt whatever as to the success of the undertaking. There would be inconvenience in the next twelve months, but if the Council gave him their support in carrying on quickly he could assure them on behalf of the staff—a most loyal and enthusiastic staff—that they would do their part in making the success of the undertaking assured.

TORRINGTON—HALWILL RAILWAY

WORK BEGUN ON NEW N. DEVON LINE.

Work has been commenced on the construction of the new line from Torrington (N. Devon) to Halwill Junction, on the London and South-Western Railway. Several attempts have been made

Mr. A. Neal, of the Ministry of Transport, cutting the first sod of the Torrington—Halwill Railway.

to launch the scheme during the last 70 years, and the accompanying photograph shows Mr. A. Neal (Parliamentary Secretary to the Ministry of Transport) cutting the first sod. The railway, which will be worked for the proprietors by the L. and S.W. Company, will serve a large stretch of agricultural country. The Government are affording financial assistance to the undertaking.

PLYMOUTH AND DEVONPORT TRAMWAYS COMPANY.

TAKEN OVER BY PLYMOUTH CORPORATION AFTER 50 YEARS' WORKING.

TRAMWAY OFFICERS REVIEW HALF A CENTURY OF SERVICE.

An event which will take its place in the history of tramway development in this country occurred on Saturday, July 1, when the undertaking of the Plymouth, Stonehouse and Devonport Tramways Company was taken over by Plymouth Corporation. The lease of the company expired the previous day, when it ceased to exist as an independent concern. The Plymouth, Stonehouse and Devonport Company was among, if not the, oldest in the kingdom. It was constituted on August 10, 1870, and was thus the first tramway concern formed under the famous Tramways Act of that year. Mr. J. Barber Glenn, now so widely known among tramway men, was appointed secretary on the date of the company's formation, and he has continued to hold that office throughout the entire life of the undertaking. During the last few years he has occupied the dual position of secretary and managing director. His active life thus covers the entire period of tramway development from the passing of the Tramways Act to the present day. He has, as most of our readers know, been associated with many other tramway undertakings both at home and abroad, and he has had an experience which in length and breadth is unmatched by any other tramway officer. Mr. Glenn rode on the first horse car run in Plymouth, used on the line 52 years ago; he travelled on the first electrical car introduced on the system in 1901 and he, with his characteristic activity, drove the last car on the night of June 30, 1922, prior to the transference of the undertaking.

The work of linking up the company's lines with those of the Corporation was completed by the last day of June. The running of the final through car on the Plymouth, Stonehouse and Devonport system was duly celebrated by the staff. At 10.45 p.m. on June 30, a gaily-decorated car with a large number of employees on the upper deck, was driven by Mr. Glenn over the entire route from Plymouth to Devonport and back to depot. Mr. Glenn was accompanied by Mr. A. E. Maddock (the manager) who has also been associated with the company for half a century. The employees enlivened the final trip by singing a variety of songs, with concertina accompaniment.

FAREWELL TO THE STAFF.

Mr. J. Barber Glenn entertained the officials and employees of the late company at a farewell supper at the Plymouth Dairy on June 28. Among those present were: Mr. A. E. Maddock, Mr. H. P. Stokes (general manager and engineer of Plymouth Corporation Tramways) and Mr. Isaac Pearse.

Mr. Maddock submitted the toast of the "Plymouth, Stonehouse and Devonport Tramways Company," and said their system was claimed to be among the oldest in the country, and they were at last to be swallowed up. They were not dying in despair, but were meeting with a natural death, for on June 30 they completed 21 years of electrified working.

Mr. Glenn, in the course of an interesting speech, outlined the history of the company's system. "I cannot part with you without a very great deal of regret," Mr. Glenn concluded, "but I am happy in knowing that Mr. Stokes is taking you over into the Plymouth service. I wish you the best of health, and I know if you do your duty as you have with the company you will have a happy future."

Mr. Stokes acknowledged the toast of his health, and reminded the gathering that while the Plymouth, Stonehouse and Devonport Company might be the pioneers of tramcars in the West, Plymouth Corporation was the first to electrify its street car system.

Chief Inspector Landry, on behalf of the company's employees, presented Mr. Maddock with an enlarged photograph of the staff. The inscription read: "Presented to A. E. Maddock Esq., manager, by the employees of the Plymouth, Stonehouse and Devonport Tramways, as a token of esteem and respect in recognition of his 50 years' service, June 30, 1922." Mr. Maddock, in acknowledging the gift, said some evidence of the efficient working of the system was that they had with eleven cars been able to carry as many as from 28,000 to 30,000 passengers in one day.

On the morning of July 1 members and officials of the Plymouth Corporation formally took over the company's system, thus affecting a unification of the local services. The Mayor (Alderman J. F. Winnicott), drove the first car over the through route, while Alderman Sir Thomas Baker (chairman of the Corporation Tramways Committee), with a specially-made key, switched on the current which will serve the joint system. The Milehouse and Compton depots were afterwards inspected and the party, which included several invited guests, adjourned to the Royal Hotel for luncheon.

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FINANCIAL REPORTS AND MEETINGS.

MAIDSTONE CORPORATION TRAMWAYS.—The accounts for the year ended March 31 show a profit of £1,373, of which £321 represents a rebate on current used in a previous year.

LOWESTOFT CORPORATION TRAMWAYS.—There was a decrease in income of £2,180 on the year's working, but expenses were less by £3,652, leaving a deficiency of £2,158.

KIDDERMINSTER AND STOURPORT ELECTRIC TRAMWAYS made a profit for the year ended December 31, 1921, of £2,149, and £114 was brought forward. A dividend of 3½ per cent. was declared.

YARMOUTH CORPORATION TRAMWAYS.—The accounts for the past year show a loss, after payment of interest and sinking fund, of £7,373. During the summer months, penny stages have been eliminated.

WARRINGTON CORPORATION TRAMWAYS.—The total income for the year ended March 31 last was £52,854, against £53,245 in the preceding year. Expenditure totalled £45,859, as compared with £46,302, and the net profit fell from £1,455 in the previous year to £173.

BIRMINGHAM AND MIDLAND MOTOR OMNIBUS COMPANY.—The net receipts for 1921 were £78,699, and £11,645 was brought forward, making £90,344. A sum of £25,000 is placed to reserve, and a dividend is declared on the ordinary shares of 10 per cent., plus a bonus of 5 per cent. The amount carried forward is £22,171.

ABERDEEN CORPORATION TRAMWAYS.—The total revenue from the tramways for the year ended May 31 last was £184,502, a decrease of £6,968 as compared with the previous year. On the working of the motor omnibuses there was an increase in receipts of £7,775, as compared with the preceding year, the total being £11,617. The aggregate receipts, £196,119, constitute a record for the undertaking.

BRIGHTON CORPORATION TRAMWAYS.—The total revenue for the year ended March 31 was £125,212, a decrease of £6,265. Working expenditure (including all renewals) amounted to £102,888, as against £110,674 last year (excluding track renewals), a decrease of £7,786. After paying interest, sinking fund, and income tax, there remains a balance of £5,538 as against £2,386. This sum has been carried to deferred renewals charges account.

IPSWICH CORPORATION TRAMWAYS.—The general manager and electrical engineer (Mr. A. S. Black) has reported to the Town Council that the financial result of the year's working was a deficit of £7,367, as compared with a loss of £7,801 in the previous year. There was a reduction in income, due to the large amount of unemployment, the average journeys per head of the population being 69·95, as compared with 76·06 for the previous year.

WILLIAM GRIFFITHS AND COMPANY, LIMITED.—The directors of William Griffiths and Company, the well known tramway and road contractors, of Hamilton House, Bishopgate, E.C., have declared an interim dividend at the rate of 15 per cent. for the half year to April 30. This dividend shows the continued prosperity of the firm, which in 1920 also paid 15 per cent., and in 1921 the same amount carrying forward in the former case £12,963, and in the latter £21,255.

ELECTRIC CONSTRUCTION COMPANY.—Presiding at the annual meeting of this company, Mr. P. E. Beachcroft said there was a reduction in the net profit for the year of only £425, compared with the previous year. The net revenue amounted to £82,684. A final dividend at the rate of 7 per cent. on the preference shares and of 9 per cent. on the ordinary shares (making 7½ per cent. for the year), plus a bonus of 2½ per cent., was proposed (all less tax). A sum of £19,714 was placed to general reserve, £30,000 to dividend equalisation fund, leaving £22,072 to be carried forward.

SCOTTISH GENERAL TRANSPORT COMPANY.—The annual report states that after deducting all expenses chargeable to revenue, and providing £5,000 for renewals, there is, with £2,743 brought forward, a surplus of £5,285, which the directors recommend should be carried forward. The sale of Airdrie and Coatbridge Tramways to Glasgow Corporation was completed on December 31, 1921, on which date Airdrie and Coatbridge Tramways Company went into voluntary liquidation. A distribution of £17 10s. per £10 share has been made and a further distribution of a small sum per share is anticipated.

BRADFORD CORPORATION TRAMWAYS.—There was a balance of £56,617 on the past year's working of Bradford Corporation tramways. The receipts amounted to £721,547; working expenses, including running and maintenance, and excluding the special renewals at £150,000, came to £588,803; income tax, interest, and sinking fund to £76,127, making a total of £664,930. In announcing the figures Alderman E. Priestley (chairman of the committee) said they were fairly well satisfied with the year's working. The deficit of £16,000 with which the year opened had been wiped out, and there was the balance already mentioned on the revenue account. It was hoped that at the end of the current year an even more satisfactory financial statement would be forthcoming, for the receipts up to the present were £1,000 more than they were at the corresponding date last year. It was proposed to transfer the balance to the renewals fund.

EXETER CORPORATION TRAMWAYS.—The annual report for the year ended March 31 last, presented to the Tramways Committee by Mr. R. Oswald Baldwin (the general manager), reveals a notable improvement in the position of the undertaking. The total revenue was £36,841, and the working expenses £29,963, leaving a gross surplus of £6,878. Interest, sinking fund and income tax charges amounted to £5,318, so that the net profit was £1,560. The District Rate made a contribution of £2,000 which, with the net surplus mentioned, has been carried forward to the Reserve and Renewals Fund account. Total traffic receipts at £36,109 established a record for the system, and represented an increase of £74 on the previous year's running. Passengers carried numbered 5,506,900, or a decrease as compared with the preceding year of 204,083. The car mileage was 434,658—an increase of 1,641.

BRISBANE ELECTRIC TRAMWAYS INVESTMENT COMPANY.—The annual meeting of this company (of whose accounts a summary appeared in our issue of June 15, 1922) was held in London on June 21. Mr. H. R. Becton (chairman of the company) presided and said the tramways had carried 1,180,381 more passengers and run 60,341 more car miles over the same length of line, and although the traffic receipts had increased by £17,563 the company had earned £10,878 less profit, due entirely to arbitrary interference with their right to adjust fares to meet the advance in wages decreed by the Industrial Court. A valuation of the whole of the company's plant, land and buildings, which was completed in December last with a view to the acquisition of the undertaking by the civic authorities, showed the then replacement value of the property, taking no account of its commercial value, to be £1,738,257. A scheme had now been formulated for the constitution of a trust to acquire and work the tramways on behalf of the local authorities, and a bill would be introduced in the Queensland Parliament in August.

MANCHESTER CORPORATION TRAMWAYS.—The report of the Manchester Tramways Committee was presented to the Council on June 27 and shows that the total revenue amounted to £1,994,576, while the working expenses were £1,519,838, leaving a balance of £474,738, or including bank interest (£2,966), £477,704. Out of this sum the following charges have been met—Interest on capital, £91,991; redemption of debt, £87,600; street improvements, £7,269; rent of lines leased, £34,272, leaving a balance of £256,572. Of this amount £37,730 was required for income tax and the balance, £218,842, has been carried to the renewals fund. Energy consumption per car mile was 1.723 units and the price paid to the Manchester Corporation Electricity Department was 1.489d. The Corporation now has 801 cars. During the year 39 cars have been put in service. The total length of track operated was 211 miles. The car miles aggregated 19,465,734, and 281,140,974 passengers were carried. The average total revenue per car mile was 24.5d. and the average working expenses per car mile including power cost 18.739d. The motor omnibuses earned £26,240, and the expenses were £25,512. The total receipts per omnibus mile were 21.966d. and the working expenses, including depreciation, 22.356d. The omnibuses ran 286,708 miles and carried 2,271,201 passengers.

IMPERIAL TRAMWAYS COMPANY.—The report for 1921 states that the revenue account includes net receipts of Middlesbrough, Stockton and Thornaby Electric Tramways from January 1 to April 2, 1921, on which date the undertaking was transferred to local authorities. Resulting from the sale of the undertaking a surplus standing at the credit of capital expenditure account of Middlesbrough, Stockton and Thornaby Tramways amounted to £122,854, and this has been transferred to the credit of the account of the company's investment in the London and Suburban Traction Company, thus writing down substantially the cost of that investment. The directors have subscribed for new ordinary shares of the Bristol Tramways and Carriage Company. Their total holding in the Bristol company now consists of 28,276 fully-paid ordinary shares, 25,000 £5 paid ordinary shares and 3,000 four per cent. preference shares. The holding in the London and Suburban Company remains at 125,000 five per cent. cumulative preference shares of £1 each and 122,120 ordinary shares of £1 each. Interest on debenture stock for the year and interim dividend on preference shares amounted to £13,650, and after placing £9,000 to reserve for depreciation and contingencies, a dividend for the year at 4 per cent. on ordinary capital, less tax, is proposed, carrying forward £282. The annual meeting was held at Bristol on June 28, the chairman of the company (Mr. Samuel White) presiding. Mr. White referred to the possibility of the Bristol Tramways and Carriage Company's undertaking being acquired by the local authority, and said it would be on terms that would give the Bristol company a price substantially in excess of the capital invested in the undertaking, and, indirectly, the Imperial

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Company would participate in that advantage to the extent of the substantial holding of shares they had in the Bristol company. The latest intimation was that the Bristol Corporation had again brought in experts to advise them.

LONDON UNDERGROUND GROUP DIVIDENDS.

The Underground Group of Railways issued on July 6 their interim dividend announcements for the six months ended June 30, 1922. The feature is the increase in the ordinary dividend of the METROPOLITAN DISTRICT RAILWAY to 1½ per cent. For the last six months of 1921 a dividend of 1 per cent. was paid, this being the first distribution for forty years.

LONDON ELECTRIC RAILWAY.—A dividend on the 4 per cent. preference stock of 2 per cent., and on the ordinary shares of 1¾ per cent. This compares with 1½ per cent. for the same period of 1921.

CITY AND SOUTH LONDON RAILWAY.—A dividend on the 5 per cent. preference stock of 2½ per cent., and on the consolidated ordinary stock of 1¾ per cent. This compares with 2 per cent. for the same period of 1921.

CENTRAL LONDON RAILWAY.—A dividend on the undivided ordinary stock of 2 per cent., and on the preferred ordinary stock of 2 per cent. The rate was the same as in 1921.

LONDON GENERAL OMNIBUS COMPANY.—A dividend on the ordinary shares of 4 per cent., free of tax. A year ago the dividend was 4½ per cent.

ASSOCIATED EQUIPMENT COMPANY.—The trading results of the Associated Equipment Company for the half-year do not justify the directors in recommending the payment of an interim dividend.

UNDERGROUND ELECTRIC RAILWAYS COMPANY OF LONDON.—The payment of 3 per cent. on the 6 per cent. first cumulative income debenture stock, and 2 per cent. on the 6 per cent. income bonds. The latter distribution compares with 2 per cent. for the same period of 1921.

BRITISH ELECTRIC TRACTION COMPANY.

MORE STABILISED INCOME.

The 26th ordinary general meeting of the British Electric Traction Company, Limited, was held on June 16 in London, Mr. J. S. Austen (the chairman) presiding.

The Chairman, in moving the adoption of the report and accounts (a summary of which appeared in our issue of June 15, 1922), said the directors proposed the distribution of a dividend of 4½ per cent., which compared with 4 per cent. paid last year. The board considered they were justified in recommending an increased dividend, as they believed the income was now more stabilised. They had earned the 4½ per cent. dividend which it was proposed to distribute, and in addition they had earned a sum of about £31,500. Of that it was proposed to put £14,000 to reserve, and to add to the carry forward about £17,000. The net results for the past year were almost exactly the same as those for the previous year. Their main business was divided into three classes—tramways, electric power, and electric light. In regard to the tramways, during the current year to date there was a falling off in receipts to the extent of some 20 per cent., but against that there was a considerable saving in expenses. On the whole, he should doubt if the general results from tramway working during the present year would be so good as in the past. As to electric power, it was obvious that owing to the engineers' strike and depression in trade there would be a decrease. Their electric lighting interests up to the present showed no sign of any set-back.

With regard to the motor omnibus business—and by that he did not refer to chars-a-bancs, which were an entirely different business—Mr. Austen remarked that at the present time the country was covered by a network of these routes. The business was not a gold mine, but there was a living in it. It was one that must essentially be conducted by large companies, which alone could adapt their services to the varying exigencies of the moment. Furthermore, the profits were not such as would stand much competition. In this respect they had not a great deal to fear, as local authorities were unlikely to allow more omnibuses to wear out their roads than the needs of the public required. That was a protection on which they could count. Their direct interest in omnibuses was mainly derived through their subsidiary company, the British Automobile Traction Company, Limited, but in addition they had a very large omnibus interest derived from their tramway companies. It was the intention of the directors, if circumstances were satisfactory, to declare an interim dividend about December next. With regard to immediate prospects, he could see no reason why there should not be steady progress in the company.

Mr. Emile Garcke (deputy chairman) seconded the adoption of the report and accounts, and the motion was carried unanimously.

GLASGOW CORPORATION TRAMWAYS.

The financial year of Glasgow Corporation Tramways closed on May 31. The accounts show an available surplus of £149,988. The following is a summary of the accounts for the year compared with the three previous years—

Year ended May 31.	1922.	1921.	1920	1919.
	£	£	£	£
Traffic receipts	2,347,219	2,388,444	1,716,491	1,527,488
Sundry receipts	3,534	4,410	5,087	3,832
Total revenue	2,350,753	2,392,854	1,721,578	1,531,320
Traffic expenses	1,007,318	1,018,501	856,111	674 664
General expenses	218,820	254,574	225,872	174,508
Maintenance and repairs ...	413,521	461,999	317,521	219,509
Power expenses	162,761	198,517	152,742	106,686
Clydebank bridges	2,232	2,475	2,314	1,753
	1,804,652	1,937,066	1,554,560	1,177,120
European War	—	599	3,601	72,869
Total expenditure ...	1,804,652	1,937,665	1,558,161	1,249,989
To net revenue account ...	546,101	455,189	163,417	281,331
Interests on investments ...	3,541	15,240	13,345	10,565
Total	549,642	470,429	176,762	291,896
APPROPRIATIONS—				
Rent of Paisley lines ...	15,635	15,722	11,093	9,755
Interest on capital	11,304	6,926	3,892	—
Sinking fund	4,527	2,674	1,715	—
Income tax	55,534	70,813	81,295	83,702
Parliamentary expenses ...	568	811	1,056	124
Renewal and depreciation ...	309,350	267,687	186,242	183,543
Total	396,918	364,633	285,293	277,124
Balance*	152,724	105,796	—	14,772
Deficit	—	—	108,531	—

* From which there falls to be deducted the balance of the deficit of 1919-20 amounting to £2,735 3s. 8d., leaving an available surplus for the Common Good amounting to £149,988.

Appended are traffic and other statistics for the year—

Average Track Mileage open during year (single) ... 197⅛

	Total.	Inc. or Dec.
Car mileage	27,024,529	+ 121,655
Traffic revenue	£2,347,218 5s. 7d.	— £41,226 0s. 10d.
Traffic revenue per car-mile	20·845d.	— ·462d.
Traffic revenue per passenger ...	1·306d.	+ ·025d.
Passengers carried	431,372,473	— 16,229,338
Passengers carried per car-mile ...	15,962	— ·676

The following statement gives the number of passengers carried at each fare—

Fares.	Year to May 31, 1922.	Per-centage.	Fares.	Year to May 31, 1921.	Per-centage.
¾d.	81,258 481	18·84	¾d.	92,227,336	20·60
1d.	163,777,422	37·97	1d.	171,519,560	38·32
1½d.	118,589,163	27·49	1½d.	118,437,023	26·46
2d.	42,602,980	9·88	2d.	41,217,253	9·21
2½d.	12,361,846	2·87	2½d.	11,899,790	2·66
3d.	6,414,445	1·48	3d.	6,003,675	1·34
3½d.	2,896,161	·67	3½d.	2,789,741	·63
4d.	2,296,728	·53	4d.	2,553,432	·57
4½d	—	—	4½d.	405,342	·09
5d. and over ...	1,175,247	·27	5d. and over	548,656	·12
	431,372,473	100·00	...	447,601,811	100·00

The weight of copper received during the year was 709 tons, and the weight of silver was 149 tons.

Since July 1, 1894, to May 31, 1922, the total passengers carried at each fare, with percentages, are as follows—

Fare.	Passengers.	Percentage.
½d.*	2,979,537,218	42·03
¾d.	173,485,817	2·45
1d.	2,908,005,756	41·02
1½d.	660,312,288	9·31
2d.	218,946,730	3·09
2½d.	71,578,534	1·01
3d. and over	77,255,011	1·09
Total	7,089,121,354	100·00

* Includes old two-stage tickets

The miles run aggregated 519,021,493, and the traffic revenue £26,689,743 1s. 3d.

BARCELONA TRACTION, LIGHT AND POWER COMPANY.—The report of the directors for the year 1921 shows that the revenue amounted to 2,065,537 dols., as compared with 1,998,878 dols. in 1920; administration and general expenses came to 160,936 dols. as against 214,783 dols. The balance of revenue available for interest on first mortgage bonds was 596,755 dols. and the interest paid on such bonds (being at the rate of 2 per cent per annum) was 753,627 dols.

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TRAMWAY AND LIGHT RAILWAY NOTES.

BIRKENHEAD.

TOP-COVERED CAR EXPERIMENT.

The Tramways Committee have decided to construct a covered top on one of the Higher Tranmere cars, as an experiment, at a cost of £170. All the cars on this route have open upper decks

BIRMINGHAM.

REVISION OF FARES.

The City Council have adopted a recommendation of the Tramways Committee that from October 1 next revised tramway fares be put into operation. The new scale provides for the retention of the 1d. fares recently instituted and for the reduction of the long-distance fares by ½d. Mr. F. Smith (chairman of the committee) said that before they could recommend any revision of fares they must be satisfied that this would not interfere with the financial stability of the undertaking. To-day the tramway under taking was in a very sound financial condition; in fact it was sounder than it had ever been before in its history. By the end of the current year the whole of the tracks within the city would have been reconstructed, and the whole cost (£1,200,000) had been found out of the revenue of the undertaking. The effect of the proposed fare reduction would be that, instead of an estimated gross profit of £377,000, they could expect a gross profit of £313,000.

BLACKPOOL.

NO ADVERTISEMENTS ON STANDARDS—MOTORMAN'S SMARTNESS.

The Tramways Committee recently received an offer to place advertisements on the tramway standards. After careful consideration the committee decided that the standards are unsuitable for advertisements, as the disfigurement to the streets would outweigh any monetary advantage to be derived from the scheme. There was also a possibility of danger to the public, and for these and other reasons it was felt that the offer ought not to be entertained. When a Corporation tramcar was proceeding along the promenade, an old man attempted to cross the track immediately in front of it. The motorman applied his emergency brake, but on realising that the car could not be pulled up in time to avoid the man, he leaned over the dashboard and pushed him on to the footpath.

BRADFORD

RAILLESS ROUTES.

The Unopposed Bills Committee of the House of Commons on June 28 passed for third reading the Bill to confirm a Provisional Order granted to Bradford Corporation in respect of their railless trolley vehicles and other matters. The Order will enable the Corporation to operate on routes outside the city, and to increase their borrowing powers.

BURNLEY.

PROPOSED TRACK RECONSTRUCTION.

The Tramways Committee have recommended an application to the Ministry of Transport for a loan of £46,950 (less £9,450 sinking fund contributions outstanding on work to be superseded), for relaying 9,390 yards of track.

CHESTERFIELD.

LOCAL TRANSPORT REORGANISATION.

The Corporation Tramways Committee propose to include the following new powers in the Corporation's Consolidation Bill—To lease their omnibus powers; to abandon new railless traction routes, and in lieu thereof to take power to convert the existing tramways to a railless trolley system; the existing motor omnibus route to be continued, with powers to run to Bakewell and other outlying places.

CROYDON.

FUTURE OF THE TRAMWAYS.

The future of the Corporation tramways, which were recently the subject of a specially prepared report by outside consultants, is the subject of much local discussion, and many ward meetings of ratepayers have considered the matter. Councillor A. A. Thomson (chairman of the Tramways Committee) addressed a meeting at Addiscombe, and said the idea of "scrapping" the system must be entirely dismissed. He was totally opposed to handing the service over to the London County Council. As to omnibuses, the London County Council had failed to get powers, so the chances of Croydon doing so were very slender. There was no reason why they should not run their own tramways as efficiently as the London County Council could. The past year's working had been very satisfactory. The meeting approved the action of the Council in directing the Tramways Committee to prepare estimates for relaying the track and to open negotiations with the London County Council for through running on reciprocal terms.

DUBLIN.

NEW SERVICE OPENED.

Dublin United Tramways Company have commenced a service between College Green and Blessington Street, via Capel Street and Bolton Street. The new facilities are much appreciated, especially by the legal fraternity attending the King's Inns.

DUNDEE.

TRACK MAINTENANCE—SEASON TICKETS.

The Corporation Tramways Committee have decided to relay two portions of the track, and to apply to the Government Unemployment Grants Committee for assistance towards the cost of the work. Mr. J. G. Fraser (convener of the Tramways Committee) said although there was talk of the discontinuance of grants towards relief schemes he thought tramway departments had an equitable claim on the Ministry of Transport for a share of the £8,000,000 collected in motor taxation towards the upkeep of roads. He advocated that joint representation should be made to the Ministry for a grant towards the upkeep of tramway track which was run over by motor vehicles. A proposal by the Tramways Committee that season tickets should be introduced experimentally has been approved by the Town Council. They will be issued to the long-distance termini where the ordinary fare is 3d., and the cost of each ticket will be £12 4s. per annum.

EDINBURGH.

TYPE OF CARS FOR NORTHERN GRADIENTS.

Mr. R. S. Pilcher (general manager of the Corporation Tramways) has prepared a report recommending the type of electric car most suitable for use on the northern routes of the city, where there are some comparatively steep gradients. Two of the declivities in question have gradients of 1 in 14 and one of 1 in 13. Mr. Pilcher has communicated with and visited a number of systems which are known to operate on steep gradients, and he states there is no reason why double-decked cars with top covers should not be used on gradients up to 1 in 9, so long as the cars are fitted with suitable slipper brakes. The gradients in Edinburgh, compared with other systems, are not nearly so difficult or so dangerous. He recommends therefore the use of top-covered, double-deck cars, fitted with slipper brakes for use on the northern routes. (An account of the inauguration of the first local electric car service will be found elsewhere in this issue.)

GATESHEAD.

NEW SAFETY DEVICE ON CARS.

Gateshead and District Tramways Company are fitting to their new front exit cars a useful device to protect alighting passengers from traffic approaching on the near side. It consists of an arm, bearing a "Danger" warning, which points out to the road when the front exit door is open.

GLASGOW.

OFFER FOR PAISLEY SYSTEM—RE-OPENING OF SUBWAY—REPORT ON TRAFFIC ORGANISATION.

Glasgow Town Council have decided to offer £250,000 for the purchase of the undertaking of the Paisley and District Tramways Company. The Glasgow Tramways Committee had recommended that an offer of £200,000 be made, but in the Town Council, Bailie M'Whirr (the Tramway Convener) moved that a quarter of a million be offered, as any less sum, he said, would not be considered by the company. The Glasgow Subway, which has been closed, and which the Corporation have decided to buy for £385,000, was re-opened on Sunday, July 2. Parliamentary authority is to be sought to work the subway as part of the tramway system. Meanwhile the subway will be managed jointly by representatives of the Corporation and of the Subway Company. The entire equipment has been overhauled, and the cars and station premises renovated. The Corporation Tramways Committee have asked a special sub-committee to consider and report on the whole traffic organisation of the tramways department. The sub-committee are also requested to report on any alteration that might be effected for the improvement of the service.

GLOUCESTER.

SUMMER FARES—LIGHT RAILWAYS ORDER.

The City Council have instituted "summer fares," with a maximum of 2d., to popularise the cars and to induce citizens to use them more frequently during the summer months, particularly for recreation purposes. The concession only applies after 2.30 p.m. The Minister of Transport has recently made the County of Gloucester (Gloucester and Brockworth) Light Railways (Revival of Powers) Order, 1922, reviving the powers granted by the Order of 1903, and extending the period for completion.

LEICESTER.

PROPOSED EXTENSION.

The Corporation has approved plans for the construction of a double line of tramways from the Groby Road corner, along Blackbird and Abbey Park Roads, to the car sheds, which will give an alternative avenue of approach. The estimated cost of the work is £60,000, and borrowing powers for this sum are to be sought.

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LIVERPOOL.

FARES AND WAGES.

Councillor F. Wilson (chairman of the Corporation Tramways Committee) told the City Council that an effort would be made to cheapen fares towards the end of the present year, but the department must first get out of debt. Liverpool was paying higher wages to its tramway employees than any other municipality in the country, and nowhere were there better cars or better tracks.

MANCHESTER.

INSPECTORS' STATUS.

A deputation of the Corporation Tramway Employees' Union urged the Tramways Committee to place the inspectors of time-papers on the administrative staff of the department. It was pointed out that this, if agreed to, would improve the status of the officials. The committee undertook to consider the suggestion.

PLYMOUTH.

NEW ROUTE OPENED.

The new track of the Corporation tramways along Alma Road was opened by the Mayor, who, accompanied by the chairman of the Tramways Committee (Sir Thomas Baker) and the general manager and engineer (Mr. H. P. Stokes) drove the first car along the route. The car used was one which had been constructed by the Tramways Department.

SHEFFIELD.

ENTERPRISING PUBLICITY.

Under the title of "Pleasure Trips and Rambles in the Sheffield District," the Corporation Tramways and Motors Department have issued an excellent booklet as an introduction to the facilities which the undertaking offers. Enclosed in a striking and artistic cover (5 in. by 7 in.) are 100 pages containing an attractively written description of the many beauty spots which, the stranger may be surprised to learn, are to be found within easy reach of the city. The reader of the booklet is told in charming fashion where to go, what to see, which car or omnibus to board, and is presented with many photographic reproductions of picturesque and historical landmarks, including Chatsworth and Haddon Hall. Corporation omnibus routes have, in fact, been so well developed that wide expanses of the countryside and moor are now easily accessible to the city population. Local firms have patronised the advertisement pages of the booklet very well, and the production as a while is a distinct credit to Mr. A. R. Fearnley (the general manager) and his staff.

SUNDERLAND.

SUPERANNUATION FOR EMPLOYEES.

On the recommendation of the Tramways Committee, the Town Council have agreed to a superannuation fund being established for the traffic employees, subject to the Ministry of Labour granting a certificate of exemption under the Unemployment Insurance Act, 1920. It is proposed that the Corporation and the employees shall each contribute 10d. per man per week. The retirement allowance will be reckoned at 50 per cent. of the wages for the time being in operation for motormen. The Corporation is not to be liable to contribute in any one year more than 20 per cent. above their present contribution under the Unemployment Insurance Act, 1920, in respect of tramway employees.

UXBRIDGE.

NEW LIGHT RAILWAY PROPOSED.

An inquiry is to be conducted by the Ministry of Transport at Uxbridge, Middlesex, on July 14, into the application of the Local Development and Light Railway Company, Limited, of 9 Victoria Street, S.W.1, for powers to construct what is to be known as the Harefield Light Railway. This will run from Harefield to Uxbridge, a distance of nearly five miles, and will have a junction line with the Great Western and Great Central Joint Railway at Denham. The motive power may be "steam or other mechanical power, excluding electricity," and the gauge will be 4 ft. 8½ in. Sir Alexander Gibb and Partners are the engineers, while the Parliamentary Agents are Baxter and Company, of 21 Victoria Street, S.W. Harefield is a small rural town which is becoming the centre of industrial developments.

WEST BROMWICH.

TRAMWAYS RECONSTRUCTION.

The Town Council have decided to apply for sanction to borrow £75,000 for the reconstruction of certain tramway routes. The work will be carried out by direct labour.

WEST HARTLEPOOL.

RAILLESS CARS TO BE INTRODUCED.

The Town Council, after considering a report by the tramways manager (Mr. T. G. Richardson), have decided to introduce railless electric traction on the Foggy Furze route, instead of relaying the tramway track.

PRESENTATION TO MR. J. M. McELROY.

A very interesting ceremony took place on June 30, at the offices of the Manchester Corporation Tramways, when the staff presented Mr. J. M. McElroy, the retiring general manager, with an inscribed gold watch, and Mrs. McElroy with a brooch. The assistant manager, Mr. James Wood, in making the presentation on behalf of the staff, paid a warm tribute to the work of the late general manager, and to his sense of justice with regard to the staff. He expressed the sincere wish that Mr. McElroy's retirement would assist him speedily to regain his health, and so enable him to enjoy his well-earned rest.

Mr. McElroy, thanking the staff for their gifts, said that in spite of the sad thoughts he had upon parting from his old associates, he was very happy to feel that at the end of his term of office he had received such expressions of goodwill from all of them.

Mr. Henry Mattinson, the new general manager, said that the undertaking had been commenced, completed, and was in full action during the course of the late general manager's term of office. He had created a high standard which would be difficult to emulate, and which could be achieved only with the whole-hearted support of the entire staff.

In the evening a complimentary dinner was given to Mr. McElroy at the Queen's Hotel. All the chief officials were present. Speeches were made, and regret expressed that Mr. McElroy's health would not permit him to continue in office.

TRANSPORT CONGRESS PUBLICITY.

A feature of the annual congress of the Institute of Transport, which was held in London from May 17-20, was the enterprising manner in which the publicity departments of various transport operating and constructional companies to whose premises visits were paid rose to the occasion. Apart from the carefully planned and wholly admirable arrangements made for the reception of the delegates on these occasions, the publicity departments of the several companies—railway, tramway, omnibus, or even aerial—appear to have put forth all their skill and ingenuity in order to present the visitors with attractive printed souvenirs of what they had seen.

The Metropolitan Railway Company prepared a charmingly illustrated booklet describing their system, particularly that part of it which runs through "Metro-land" to the north-west of London, and also a neat folder giving technical details of the Neasden power-station and the latest of the company's electric and superheated steam locomotives.

The London Underground Railways and the General Omnibus Company offered their visitors a beautifully bound and printed account of the Chiswick omnibus overhaul depot, containing many illustrations, and entitled "The Re-birth of the Motor Omnibus." Another attractive publication of the joint companies was a booklet giving short, crisp facts about the whole undertaking, including the Lots Road power-station, the Underground lines, the omnibus fleet, and the works of the Associated Equipment Company, Walthamstow.

When the members of the Congress visited the Greenwich power-station and the Charlton central repair depot of the London County Council Tramways, they were handed an attractive booklet containing much information about the system—its mileage, passengers carried, average speed, financial statistics, etc.—followed by an illustrated description of "The 1922 Tramcar," the central repair depot, and the Greenwich station. The booklet concluded with a reproduction of one of the series of posters which the tramways department issue monthly.

Dennis Brothers, Limited, of Guildford, supplied their visitors with several artistic productions, in which the firm's commercial and municipal motor vehicles and fire engines were fully described and illustrated in colour. A long list was included of all the many civic authorities who use Dennis models. On the cover of the booklet devoted to turbine motor fire engines was a striking colour-print depicting a Dennis vehicle passing down Guildford main street, with the distant glow of a fire in the night sky. A pamphlet related the history and notable achievements of the firm, and enumerated its latest products.

To illustrate the paper read to the Congress by Sir John E. Thornycroft, K.B.E., on "The Future Design of Road Vehicles," a very pleasing album of photographs was provided. This contained illustrations of the special types of motor vehicles dealt with, and revealed several ingenious loading and discharging contrivances.

The London and North-Western Railway issued a booklet, with photographs, for the benefit of those who visited Euston Station and Stonebridge Park electrical power-station, while the Great Western Railway provided an illustrated description of their signal department works at Reading.

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PERSONAL.

Mr. G. H. Swingler, city electrical engineer of Capetown, is to visit England on leave.

Mr. A. A. Campbell Swinton has joined the board of W. T. Henley's Telegraph Works Company.

Mr. A. A. Watkins, who, before going to Australia, gained experience of tramway operation in Great Britain, has been appointed chief engineer of Adelaide Municipal Tramways.

Mr. Richard Enright, the New York Police Commissioner, and **Colonel Thompson,** chairman of the New York Traffic Committee, are visiting Europe to study methods of traffic regulation.

Councillor A. S. Dutton has been appointed chairman of the Chester Corporation Tramways Committee in succession to the late Alderman John Jones. **Councillor A. Hart Davies** has been appointed deputy chairman.

Mr. Percy G. Campling, deputy engineer and manager of the Rhondda Tramways Company, has been appointed general manager of Yarmouth Corporation Tramways at a salary of £400 per annum. There were 119 candidates.

Mr. H. Richardson, manager of Dundee Corporation electricity undertaking, has been appointed general manager of the Metropolitan Electric Supply Company, in succession to Mr. W. R. Rendell, who has resigned on account of ill-health.

Sir Charles Parsons has received the degree of Doctor of Engineering of Sheffield University. In introducing Sir Charles, Professor Leahy described the invention of the Parsons' turbine as the greatest in steam power generation since the days of James Watt.

Mr. J. H. Taylor, assistant engineer of the Central Argentine Railway, has been awarded the "George Stephenson" medal, the gold medal of the Institution of Civil Engineers, for his paper on "The Application of Electric Traction to the Suburban Lines of the Central Argentine Railway."

The Commercial Motor Users' Association have elected their president, **Mr. E. S. Shrapnell-Smith, C.B.E.,** and general secretary, **Mr. F. G. Bristow, F.C.I.S.,** to represent them at the fourth International Road Congress, which is to be held at Seville in May 1923, under the patronage of the King of Spain, and with the support of the British Government.

Mr. John Sutherland, who has been stationmaster at Baker Street Station since 1903, retired at the end of June after nearly 42 years' service with the Metropolitan Railway Company. Mr. Sutherland saw the whole of the transformation from steam to electricity and the rebuilding of the station, which occupied three years, without any interruption of traffic. During his period at Baker Street the daily traffic has increased from 900 to 1,400 trains per day.

Mr. Duncan P. Morrison, the former manager and engineer of Tynemouth and District Electric Traction Company, who recently retired, has been presented with a silver tea service and tray by the staff. Mr. J. A. Somerville (late of Swansea), the newly appointed manager, presided over the gathering, and Mr. J. Davidson, the oldest member of the staff, made the presentation. Mr. Morrison, in returning thanks, paid a tribute to the loyal assistance he had always received from the staff.

Mr. J. M. McElroy.—The meeting of Manchester Corporation Tramways Committee on June 27 was the last to be attended by Mr. J. M. McElroy, the general manager, who has been associated with the undertaking for 21 years, and who is about to retire. Alderman J. Bowes (chairman of the committee) took advantage of the occasion to refer in appreciative terms to Mr. McElroy's long and distinguished service. Incidentally, it may be recalled that it is exactly 21 years since the first tramway route was opened in Manchester.

Institute of Transport Appointments.—The following appointments for the year 1922-23 have been made by the Council—Honorary president, Lord Ashfield; president, Sir Sam Fay; past presidents, Sir Eric Geddes and Sir Henry P. Maybury; vice-presidents, Sir J. G. Broodbank, Sir Lynden Macassey, Sir Henry W. Thornton, Mr. H. H. Gordon, Mr. E. S. Shrapnell-Smith, and Mr. Arthur Watson; honorary treasurer, Sir Philip Nash; honorary solicitor, Sir William Joynson-Hicks, Bart. At the express wish of the Council, Mr. H. E. Blain has consented to retain the office of hon. secretary for another year.

Mr. Clement Jackson, motor omnibus superintendent of Sheffield Corporation Tramways, has been appointed general manager of Keighley Corporation Tramways in succession to Mr. J. A. Bromley, who has accepted the managership of the York undertaking. Mr. Jackson, who is 29 years of age, received his training at Sheffield. His salary will be £400 a year. There were 92 applicants for the position, and those selected for interviews in addition to Mr. Jackson were Mr. Colin Milton, B.Sc., assistant tramways engineer and manager to the Eccles Corporation; Mr. Thomas Godley, deputy engineer and manager, Dumbarton Burgh and County Tramways; and Mr. J. R. Taylor, deputy manager of the Walsall Tramways.

ELECTRIC LOCOMOTIVES FOR JAPAN.

LARGE CONTRACT PLACED WITH THE ENGLISH ELECTRIC CO.

The Imperial Government Railways of Japan have placed with the English Electric Company for their Dick Kerr works at Preston an order for 34 complete electric locomotives of the total value of upwards of £500,000. This represents the whole requirement of locomotives up to the end of 1923 for those sections of their main line railways which the Japanese Government have decided to electrify at once. The order was obtained in the face of keen foreign competition, particularly from America, and was placed with the English Electric Company after the fullest investigation by Japanese engineers into the systems in operation in different parts of the world, owing to their confidence in the excellence of British design and workmanship.

Eight of the locomotives now ordered are for heavy express passenger service. They are of the 2-C-C-2 type. Their weight is approximately 96 tons, and they are designed to haul a 415-ton train at a balancing speed of about 60 miles per hour. Each locomotive is equipped with 6 D.K. 86A motors rated at 306 H.P. at 500 volts, the motors being connected in two groups of three in permanent series on a trolley voltage of 1,500 volts. The control equipment is of the standard English Electric camshaft multiple unit type.

Of the remaining locomotives, 9 are for local passenger service and 17 are for heavy freight service. These 26 are all of the B-B type, and will weigh approximately 56 tons each. They are equipped with 4 D.K. 86A motors similar to those on the express passenger locomotives, but in this case the motors will be connected in two pairs in permanent series. Here, too, the control is the standard English Electric multiple unit type. The locomotives for local passenger service are designed to haul a 315-ton train, and the freight locomotive a 600-ton train, the balancing speeds being about 55 and 40 miles per hour respectively.

ELECTRIC LOCOMOTIVES FOR PARIS-ORLEANS RAILWAY.

The Paris-Orleans Railway has recently placed an order for 80 electric locomotives with the Société Oerlikon and the Société de Construction des Batignolles, both in Paris. These locomotives are each for a 1-hour rating of 1,720 H.P. The Société Oerlikon is to supply and erect the electrical equipment, while the Société de Construction des Batignolles deals with the mechanical part. Except in the case of the first five locomotives, which will be completed in Switzerland at the works of the Ateliers de Construction Oerlikon, and will serve as models, the whole electrical equipment will be built in France, to the Oerlikon design, at the works of the Société Oerlikon.

The locomotives are specially intended for goods trains, and are to be capable of hauling a load up to 1,200 tons. They are, however, also to be suitable for passenger service, in which case a speed of about 68 miles per hour must be attainable. The locomotives are equipped with four motors wound for 1,500 volts D.C., and having each an output of 430 H.P. measured at wheel rim.

The Ateliers de Construction Oerlikon are represented in this country by Messrs. Oerlikon, Limited, of 34-35 Norfolk Street, Strand, London, whose general manager and chief engineer is Mr. G. Wuthrich, M.I.E.E.

DEVELOPMENT OF STAINLESS STEEL.—The results of many experiments and tests which Thomas Firth and Sons, Limited, of Sheffield, have conducted in their works and research laboratories to prove the valuable qualities of stainless steel have now been collected and published by the firm in book form.* The company have been led to do this in order to meet the continual requests for information as to the behaviour of stainless steel under various conditions. In this connection it will be remembered that in our issue of November 17, 1921, an article was published with illustrations that testified to the remarkable resistance of turbine blades treated by Messrs. Firth's process during 15 months' service. "The special properties of stainless steel, as already established by a number of years' service," the preface to the book states, "render it a valuable material for many purposes where ordinary steel is either less effective or unsuitable. In many cases, stainless steel is replacing some of the non-ferrous metals owing to the high mechanical strength which is associated with its non-staining and non-rusting properties." In a list of over 200 articles and machinery parts in the manufacture of which stainless steel has been either actually used or suggested, we notice the following—trolley wires, turbine blading, nozzles, etc., wheels, gears, shafts, ventilators, decorative metal work, petrol engines and parts, contact breaker levers, condensers, ball bearings, etc.

* The Development of Stainless Steel: Its properties and uses.—p.p. 82, price 10s. 6d.

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CONTRACTS AND ORDERS.

Motor Car for Dundee Tramways.—Dundee Tramways Committee have decided to buy a second-hand two-seater motor car for £200.

The British Thomson-Houston Company's tender for a rotary converter, switchgear, etc., at £2,753, has been accepted by York Corporation.

Sheffield Tramways Committee have accepted the tender of H. Bessemer and Company, Limited, for 400 steel tramcar tyres at £2 17s. each.

Messrs. M'Hardy and Elliot, coachbuilders, Low London Road, Edinburgh, have received an order from Salford Corporation Tramways for 12 tramway car top covers.

Messrs. Cammell Laird and Company have received orders for 400 all-steel covered goods wagons, 150 for the Great Indian Peninsula Railway, and 250 for the Assam-Bengal Railway.

Cars for Melbourne.—A Reuter's telegram states that the Melbourne Tramways Board propose shortly to invite tenders for the supply of 60 single truck electric tramcars, the delivery to be spread over a period of two years.

Keighley Town Council have decided to purchase the two motor omnibuses at present on hire from Leyland Motors, Limited, at £1,575 (net) each; also to buy an electric arc welding plant at an estimated cost of £316, for use on the tramway track.

Karriers for Westminster.—The Highways Committee of the Westminster City Council recommend the purchase of five 3-4 ton chassis from Karrier Motors, Limited, at £710 each, and the provision of bodies at £203 each, by the Eagle Engineering Company.

New Electrics for Sheffield.—Sheffield Corporation Health Committee have purchased five electric vehicles from the General Vehicle Company, and one from Clayton Wagons, Limited, but are of opinion that it is not desirable in these particular cases to disclose the contract prices.

Burnley Tramways Committee recommend the purchase of three miles of 3/0 round copper trolley wire at 10½d. per lb., less 2½ per cent., from F. Smith and Company, Limited (Salford); 12 gear wheels at £11 15s. 9d. each, and 12 pinions at 18s. each, from A. Wiseman, Limited (Birmingham); and 1,500 Wrendal lamps at 1s. 3d. each, from L. Andrew and Company, Limited (Manchester).

Wolverhampton Tramways Committee have accepted the tenders of Messrs. Eadie Towers and Company, of Wolverhampton, for the construction of the tramway track in Waterloo Road (from Darlington Street to Newhampton Road), amounting to £3,871 14s. 7d., and of the Rail Welding Company, Limited (of London), for welding the joints of the new track to be laid in Waterloo Road, and welding and re-treading joints in the portion of the track where maintenance work is to be executed during this summer.

New Peking Tramways.—A Reuter's telegram states that the following tenders have been accepted for the supply of plant, machinery, rolling stock, etc., in connection with the new Peking tramways—Boilers, Messrs. Babcock and Wilcox (109,000 gold dollars); engines and generators, Brown, Boveri and Company (109,000 gold dollars); transformers, Siemens Company (German) (24,000 gold dollars); rails, French Company, through the Anglo-French Corporation (295,000 gold dollars); cars, same tenderers (£55,000); overhead equipment, Siemens Company.

PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given in italics.

APPLICATIONS FOR LETTERS PATENT.

The number of the patent is given in brackets.

Method of forming joints between tramway rails (15,011)—H. W. A. Brown.
Combination of internal combustion engine and compressor for power propelled vehicles (15,565)—Daimler-Moteren Ges.
Tramways and railways (15,543)—F. E. Down.
Motor vehicles (15,030)—E. C. G. England.
Trolley retrieving stands (15,342)—A. C. van Hooydonk.
Tramways and railways (15,086)—D. H. Walters.
Rear axles of motor vehicles (15,095)—E. E. Williams.
Current collector bow for electric vehicles (16,075)—C. Conradty.
Brakes for motor vehicles (15,939)—E. S. Coward.
Controlling gear for electric motors (16,162)—English Electric Company, Limited, and L. Rothera.
Variable speed and torque gear for motor vehicles (16,129 and 16,130)—R. H. Hopkinson and V. Hopkinson.
Brake system for motor vehicles (16,023)—D. A. Meek (*J. A. Davenport*).

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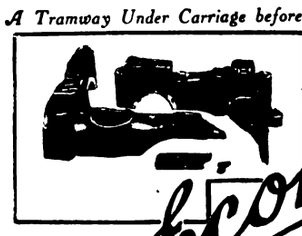
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Motor vehicles (15,694)—A. E. Osborn.
Fluid pressure brakes for automobiles (15,932)—A. V. Tomlinson (*Soc. d'Applications Westinghouse aux Automobiles*).
Speed indicators for motor vehicles (15,916)—A. R. Upward.
Safety guards for road vehicles (16,634)—F. M. Ballard.
Motor vehicles (16,732)—M. J. B. Barbarou.
Welded joints for tramways, etc. (16,565)—H. Bolton.
Running gears for motor vehicles (16,267)—G. B. Ellis (*Goodyear Tyre and Rubber Company*).
Lifting jacks (16,749)—P. de Q. Gaivas.
Variable speed gearing for motor vehicles (16,292)—G. N. Motors, Limited, and A. G. Frazer-Nash.
Variable gear for motor vehicles (16,581)—W. L. Lawrence.
Motor vehicles (16,604)—W. Muller.
Trucks for tramway vehicles (16,733)—Peckham Truck and Engineering Company, Limited, and S. Thomas.
Overhead switches for electric trolley conductors (16,797)—L. Vallino.
Welded joints for tramways, etc. (16,565)—G. Wallace.
Variable gears and friction transmission for motor vehicles, etc. (16,868)—A. H. L. Beale and J. B. Taunton.
Cooling systems for motor vehicles (16,869)—A. H. L. Beale and J. B. Taunton.
Steering gears for motor vehicles (16,870)—A. H. L. Beale and J. B. Taunton.
Motor vehicles (16,871 and 17,451)—A. H. L. Beale and J. B. Taunton.
Flexible current collector for metallic netting type of overhead electric conductor (17,078)—L. A. Hackett.
Mechanically propelled vehicles (16,828)—R. F. Hall.
Variable speed gearing for motor vehicles (16,990)—V. Johnson.
Cooling means for internal combustion engines of motor vehicles (17,256)—H. W. S. Martin and W. Yates.
Carburation apparatus for engines of motor vehicles (16,905)—A. Phillip.
Life-guards for motor vehicles (17,383)—C. Pickering.
Rail joint (17,646)—W. E. Backhouse and A. Lawson.
Steering wheels of motor vehicles (17,742)—F. W. Bowden.
Lifting jacks (17,863)—W. Everett.
Control of electric motors for traction (17,677)—T. Ferguson and Metropolitan Vickers Electrical Company, Limited.
Running gear for motor vehicles (18,047)—Goodyear Tyre and Rubber Company.
Lubricating devices for axle journals (17,841)—W. Holtorp.
Trolleys for electric tramways (17,647)—W. Lawrence.
Rail joints (18,068)—J. T. Miller.
Rail track fastenings (18,071)—F. Radelet.
Passenger motor vehicles (17,917)—C. S. Windsor.

Specifications Published

1920

Driving or power axles for motor vehicles (36,226—*179,223*)—A. E. Alexander (*Three Point Truck Corporation*).
Brake blocks for tramway and other vehicles (32,636—*154,164*)—A. Chaumont.
Motor vehicles (36,227—*180,367*)—A. E. Alexander (*Three Point Truck Corporation*).

1921

Emergency brakes for vehicles (4,138—*179,314*)—N. E. Willis.
Safety apparatus for electric tramways (7,340—*179,369*)—S. H. Trippe.
Devices for driving or propelling motor vehicles (7,871—*179,376*)—V. Zboril.
Steps and life-guards for tramcars (8,993—*179,387*)—W. E. Ireland.
Tramway rail joints (12,775—*170,265*)—L. Ekberg.
Rear axle and driving means for motor vehicles (15,542—*179,450*)—F. J. Brougham (*Atlas Truck Corporation*).
Apparatus for filing the surface of tramway rails (1,899—*179,587*)—C. Oxley.
Driving or transmission mechanism for motor vehicles (5,421—*179,685*)—J. R. Churchill.
Trolley wheels for the poles of electric tramcars (5,713—*179,698*)—E. Nightingale and E. Nightingale.
Steering axle end for motor vehicles (7,869—*179,739*)—S. E. Alley.
Driving mechanism for motor vehicles, etc. (16,403—*179,843*)—A. E. White (*Mercury Manufacturing Company*).
Brake mechanism for mechanically propelled vehicles (32,799—*172,636*)—M. N. Viratelle.
Friction transmission gear for motor road vehicles (2,057—*179,979*)—E. G. Blake.
Lubricating systems for motor vehicles (2,257—*179,984*)—J. H. Dickinson.
Lifting jacks for road vehicles (2,428—*179,988*)—G. C. E. Hampden.
Trolley pole attachments for electric trams (4,325—*179,996*)—P. Priestley.
Safety wheel guard obstruction remover for motor vehicles (6,961—*180,096*)—W. Thompson and W. J. Gooding.
Ignition devices for internal combustion engines (8,009—*180,113*)—British Thomson-Houston Company, Limited.
Hoods for motor chars-a-bancs (17,858—*180,233*)—E. Redfern.
Road and rail vehicles (22,483—*180,255*)—N. Howe.
Fish-plates or joining plates for tramway rails, etc. (23,347—*180,260*)—D. Faulkner.
Automatic motor vehicle jack device (23,863—*180,261*)—G. H. Willems.
Suspension or springing of power propelled vehicles (2,985—*180,383*)—F. W. Lanchester.

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1921. WEEKS ENDED June 4	June 11	June 18	June 25	July 2	1922. WEEKS ENDED June 3	June 10	June 17	June 24	July 1	AGGREGATE. Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	1.526	2.753	3.656	3.520	3.983	3.935	3.727	3.763	3.685	3.639	4½	15.014	+ 1.102
Aberdeen Motor Buses	593	634	213	270	326	319	236	245	269	240	4½	1.001	− 443
Ayr Corporation	659	705	692	686	793	640	685	689	661	730	7	4.630	− 114
Barrow Corporation	851	863	821	886	951	670	847	645	565	580	13	8.087	− 3.552
Belfast City Tramways	13.090	14 024	11.619	13.495	13.541	10.911	11.381	11.899	11.652	11.882	13	154.333	− 15.721
Birkenhead Corporation	2.339	2.303	2.452	2.529	2.725	2.498	2.641	2.307	2.238	2.384	13	33.149	− 181
Birkenhead Motor 'Buses	817	797	800	820	925	838	1.098	761	705	758	13	9.906	+ 329
Birmingham Corporation	28.255	29.334	28.932	28.684	29.517	29.112	29.967	28.171	28.021	28.140	13	378.284	− 15.656
Birmingham Motor 'Buses	2.143	2 286	2.212	2.177	2.282	2.056	2.528	1.897	1.881	1.754	13	25 087	− 4.390
Blackburn Corporation	1.445	1.832	2.159	2.261	2.404	2.766	3.512	2.553	2.316	2.225	13½	33.949	+ 6.017
Bradford Corporation	11.163	11.258	11.458	11.817	12.784	14.716	17.014	14.827	13.797	13.689	14	189.789	+ 19.147
Burnley Corporation	2.859	3.014	2.654	2.878	3.101	3.299	3.851	3.206	3.200	3.153	—	—	—
Burton-on-Trent Corporation ...	577	575	664	593	562	606	611	547	547	556	13	7.390	− 734
Bury Corporation	1.949	2.230	2.380	2.429	2.576	2.544	3.039	2.586	2.289	2.335	13½	33.583	+ 1.216
Chatham and District	1.485	1.562	1.527	1.519	...	1.886	2.209	1.784	1.805	...	25	39.775	− 577
Chesterfield Corporation	1.255	1.299	1.269	1.298	1.313	1 212	1.383	1.285	1.147	1.105	12	15.544	− 1.360
Derby Corporation	1.629	1.618	1.644	1.675	3.444	2.287	2.537	2.125	2.064	2.044	13	28.472	+ 693
Dundee City	3.434	3.592	3.438	3.501	3.685	3.246	3.220	3.230	3.081	3.057	6½	19.728	− 2.345
East Ham Corporation	2.057	2.095	2.095	2.095	2.157	2.179	2.434	2.109	2.124	2.169	13½	28.755	+ 968
Edinburgh Corporation	13.375	13.200	14.020	13.986	16.584	13.227	17.431	12.353	12.051	14.578	7	89.674	− 8.238
Edinburgh Motor 'Buses	4.271	4.335	4.220	4.057	4.788	3.906	3.972	3.830	3.465	4.471	7	26.933	− 3.258
Glasgow Corporation	51.068	50.183	49.390	48.576	50.225	47.072	46.202	45.564	43 567	44.924	4½	202.515	− 18.751
Glossop (Urban Elec. Supply Co.)...	191	196	213	213	204	226	247	222	210	222	26	5.908	− 125
Halifax Corporation	3.629	3.736	3.609	4.095	4.246	4.711	6.416	4.578	4.235	4.059	12½	56.381	+ 4.553
Halifax Motor 'Buses	101	99	97	101	107	82	93	71	88	92	12½	860	− 490
Halifax Railless Cars	...	...	...	...	...	38	107	54	33	29	12½	708	—
Huddersfield Corporation	5.430	5.441	5.535	5.463	5.638	5.575	6.906	5.316	5.204	5.102	14	76.021	− 2.654
Ilford U.D. Council	1.538	1.598	1.605	1.662	1.595	1.552	1.689	1.480	1.508	1.475	13½	20.066	− 508
Ipswich Corporation	736	771	781	804	799	891	1.020	808	845	822	13	11.036	+ 682
Isle of Thanet...	902	1.072	1.365	1.514	1.786	1.054	1.699	1 306	1.617	1 558	38½	29.293	+ 1.203
Kilmarnock Corporation	384	363	363	357	378	335	333	327	334	338	6½	2.252	− 306
Leicester Corporation	5.002	5.658	6.181	6.612	6.949	7.986	8.312	7.344	7.294	7.178	26	191.264	− 35.303
Liverpool Corporation	25.797	28.152	28.886	29.566	31.599	31.325	32.721	29.740	28.857	29.231	26	760.567	+ 36.841
London County Council	102.624	105.059	106.032	103.889	105.415	98.672	104.917	94.978	95.370	94.217	12½	1.211.645	− 100.406
Maidstone Corporation	392	415	430	424	489	475	569	452	472	468	12½	6.409	+ 236
Manchester Corporation	40.131	40.994	39.548	39.495	41.305	36.149	36.775	35.260	33.914	33.883	13	476.896	− 49.048
Newcastle-on-Tyne Corporation ...	10.656	10.886	10.903	17.127	10.463	10.541	10.879	10.000	14.703	9.689	13	136.705	− 11.332
Nottingham Corporation	3.971	3.801	5.339	5.412	5.885	7.930	8.779	7.506	7.539	7.314	13	99.934	+ 30.138
Oldham Corporation	4.672	4.587	4.597	4.692	4.765	4.935	5.045	4.582	4.300	4.389	14	66.161	− 2.172
Preston Corporation	1.860	1.928	1.803	1.812	1.933	1.876	2.172	1.761	1.705	1.728	12½	23.124	− 1.236
Preston Motor 'Buses	...	...	...	...	...	127	153	121	120	127	12½	1.644	—
Reading Corporation	1 452	1.440	1.620	1.610	1 633	1 605	1 845	1.580	1.547	1.470	13	20.303	+ 506
Reading Motor 'Buses	361	380	346	360	355	350	486	346	367	337	13	4.530	+ 45
Rotherham Corporation	2.017	1.994	1.955	1.993	1.949	2.190	2.356	2.342	2 000	2.046	12	25.960	+ 1.239
St. Helens Corporation	1.783	1.849	1.804	1.873	1.898	1.714	1.937	1.719	1.467	1.450	13	20.334	− 2.423
Salford Corporation	11.098	10.808	10.804	11.356	12.087	11.207	13.170	10.335	9.100	9.402	13½	140.342	− 9 229
Sheffield Corporation...	19.636	21.995	19.707	19.835	20.234	19.082	20.827	17.925	17.497	18.166	13½	244.671	− 13.768
Southampton Corporation	2.125	2.224	2.411	2.606	2.825	3.354	3.898	3.224	3.252	3.055	13	40.403	− 7.220
Southampton Motor 'Buses	412	426	374	284	219	98	97	97	100	101	13	1.277	− 2.487
Southend Corporation	1.866	2.044	2.253	2.369	...	2.433	3.749	2.806	2.872	...	12	29.500	+ 7.505
South Shields Corporation	1.565	1.584	1.587	1.822	1.563	1.848	2.231	1.733	1.894	1.743	13	23.105	− 2.519
Sunderland Corporation	2.508	2.471	2.638	2.804	2.655	2.814	3.156	2.489	2.585	2.470	13	33 873	+ 824
Swindon Corporation	376	389	389	441	416	382	437	368	345	337	12½	4.661	− 508
Tyneside Tramways and Tramroads	1.212	1 275	1.147	3.207	...	961	1.123	886	2.556	...	25	25.572	− 6.495
Wallasey Corporation	2.589	2.839	2.657	2.788	3.054	2.764	3.348	2.670	2.529	2.506	13½	34.784	− 1.596
Wallasey Motor 'Buses	205	270	211	244	331	282	340	266	215	232	13½	3.211	71
Walsall Corporation	1.566	1.592	1.618	1.591	1.618	1.555	1.792	1.443	1.448	1.484	13	21.124	− 817
Walsall Motor 'Buses	802	789	831	804	858	792	1.240	652	652	665	13	11.401	− 386
Walthamstow U.D. Council	2.201	2.314	2.398	2.356	2.321	2.115	2.622	1.985	1.908	1.823	13½	26.299	− 3.183
Warrington Corporation	821	857	848	946	1.040	977	1.006	932	894	992	13	12.603	+ 178
West Ham Corporation	5.184	5.417	5.745	5.780	6.272	5.871	6.529	5.497	5.445	5.647	12½	74.588	− 568
Wolverhampton Corporation ...	2.136	2.218	2.166	2.170	2.270	2.172	3.131	2.031	1.903	1.872	13	28.100	− 1.421
Wolverhampton Motor 'Buses ...	588	612	618	592	621	631	964	614	587	564	13	8.465	− 377

Underground Electric Railways Company of London, Limited.

NAME OF COMPANY.	1921. WEEKS ENDED June 4	June 11	June 18	June 25	July 2	1922. WEEKS ENDED June 3	June 10	June 17	June 24	July 1	AGGREGATE. Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Underground Rlys. & L.G.O. Co. ...	244.143	251.405	251.810	247.854	251.013	248.956	260.368	236.193	240.116	230.910	26	5.828.568	− 335.804
London and Suburban Traction ...	55.426	59.826	60.886	60.355	61.563	57.591	64.370	52.460	52.901	50.205	26	1.273.730	− 122.002

Colonial and Foreign Tramway Traffic Returns.

Companies Issuing Weekly Returns.

NAME OF COMPANY.		1921. WEEKS ENDED June 4	June 11	June 18	June 25	July 2	1922. WEEKS ENDED June 3	June 10	June 17	June 24	July 1	AGGREGATE. Wks.	1922.	Increase or Decrease.
		£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine		81.776	79.776	75.607	74.858	68.648	83.407	83.945	76,951	79.907	73,999	26	2.166.456	+ 90.697
Calcutta	Rs.	81.280	87.345	84.271	86.467	91.744	105 262	107.286	107.672	98.712	107.132	26	2.757.387	+ 833.253
Madras...	Rs.	50.343	(2 weeks)	47.759	(2 weeks)	46.115	48.498	(2 weeks)	47.439	(2 weeks)	45.725	26	586.404	+ 146.235
Pernambuco		3.769	3.575	3.165	3.060	2.858	2.531	3.485	3.112	3.156	2.789	26½	90.342	− 16.908

Companies Issuing Monthly Statements only.

	1921. Jan.	Feb.	Mar.	April	May	June	1922. Jan.	Feb.	Mar.	April	May	June	Wks.	AGGREGATE. 1922.	+ or −.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo	4.594	4.701	4.935	5.121	...	...	4.805	4.797	5.244	5.473	...	...	4	5.473	+ 352
Brazilian Trac. Mlrs	12875000	11941 000	13102000	13562000	14462000	...	15032000	14473000	15238000	15413000	16093000	...	21	76.249.000	+ 10307000
Brisbane	46.280	43.205	46.300	47.750	...	...	48.790	43.800	51.300	48.700	...	...	17	192.590	+ 9.055
British Columbia	$ 908.385	838.682	867.083	835.793	826.039	...	907.242	821.828	849.680	818.177	827.701	...	48	9.417.543	+ 124.190
Buenos Ayres L'c'z	61.111	53.952	59.365	60.238	58.492	...	61.198	55.227	61.775	57.619	59.278	...	47	631.716	+ 9.272
Burma	50,035	48.405	50.931	50.159	48.353	...	59.362	52.380	60.296	58.631	65.357	...	43	587.411	+ 80.800
Cape Town	...	...	...	27.662	27.407	...	30.289	26.980	29.930	28.657	28.006	...	—	—	—
Carthagena & H. ...	3.877	2.839	2.226	2.329	1,602	1.410	3.075	2.773	2.145	2.991	2.793	1.174	26	14.951	+ 668
Cordoba	18.696	18,600	21,717	...	...	...	22.152	21.918	25.382	...	...	...	52	277.368	+ 39.922
East India ...	4.299	3,819	4.168	4.560	4.392	4.494	4.080	3.737	4.446	4.065	3.960	3.640	48	44.682	− 2.191
Kalgoorlie... ...	2.418	316*	2.485	2.398	...	...	2.180	2.031	2.390	2.538	...	...	17	9.139	+ 1.522
La Plata	6.506	728*	3.403*	...	...	5.187	6.724	6.318	7.067	...	...	5.883	26	39.311	+ 11.420
Manila ...	$ 321.449	306,389	298.317	279.534	293.873	...	309.252	310.001	284.576	286.044	273.218	...	21	1.463.111	− 36.495
Monte Video ...	50.863	48.119	48.925	46.189	46.579	42.960	32.634	48.111	51.158	47.960	48.074	44.298	34	371.791	− 4.625
Para	24.231	20.545	22.189	22.289	22.705	...	22.966	21.582	22.238	23.061	23.651	...	26	136.158	− 54
Port Elizabeth ...	...	...	...	7.082	6.304	...	8.120	6.690	7.851	6.892	6.713	...	—	—	—
Rangoon ...	Rs. 122.588	120.718	158.121	125.163	138.950	130.000	137.850	130.583	150.500	139.375	145.450	140.400	26	844.158	+ 48.648
Winnipeg ...	$ 506,229	460,125	495.208	462,378	433,836	...	507.047	498,577	464.900	435,058	427,880	...	22	2.299,272	− 58.504

* Strike of Employees.

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Perth Corporation Tramways.
Malta Tramways Company.
Coventry Corporation Tramways.
Exeter Corporation Tramways.
Aberdare Corporation Tramways.
Rotherham Corporation Tramways and Omnibuses.
Darlington Corporation Tramways.
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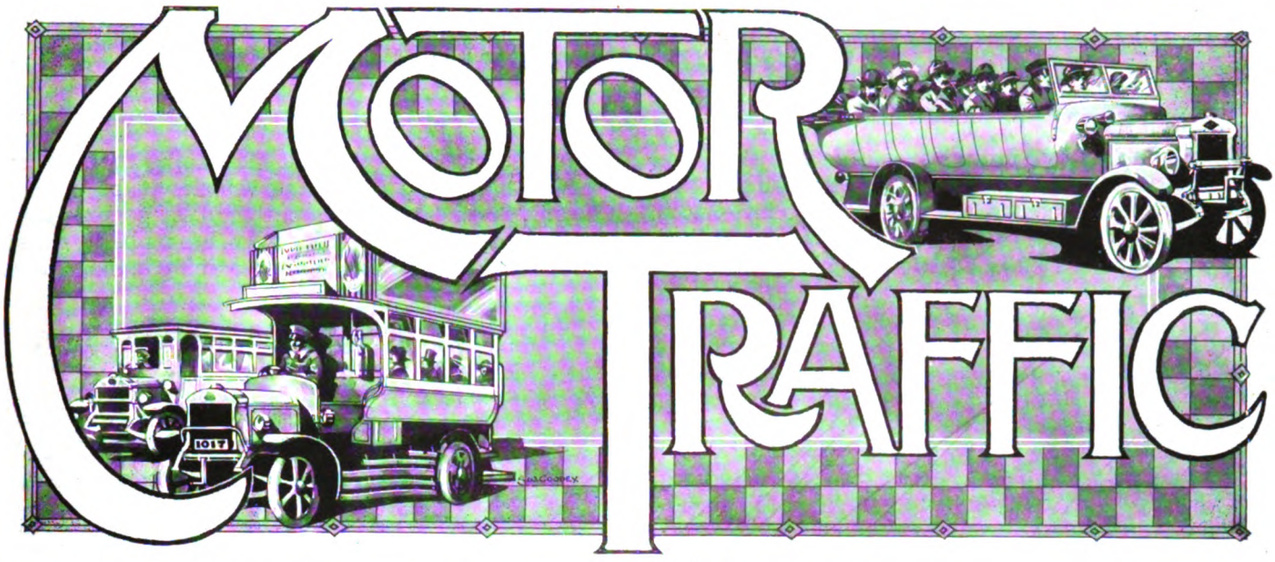

MOTOR TRAFFIC SECTION—SEVENTEENTH YEAR OF PUBLICATION.

THE CAPACITY OF MOTOR OMNIBUSES.

There is a decided tendency to increase the carrying capacity of motor omnibuses for regular use in towns, while there is at least some tendency to decrease the capacity of motor coaches or omnibuses for service on country roads. The theory underlying the provision of more seating accommodation on vehicles plying in big centres of population is obvious. The greater the capacity of the unit, assuming that the prescribed overall dimensions are not exceeded, the larger the volume of traffic that can be handled without undue congestion of the thoroughfares. Moreover, the cost per passenger goes down with every increase in the seating accommodation, with the result that, if vehicles of large capacity are used, fares may be lowered, and the popularity of the service may thus be increased. On the other hand, there is more than one reason for limiting the accommodation provided in motor omnibuses. One is, of course, that the licensing authority quite properly does not allow certain dimensions to be exceeded. Again, the larger the unit employed, the lower is the average speed of conveyance, owing chiefly to the longer time occupied in taking up and setting down passengers. If, for instance, the average journey of a passenger is one mile and the omnibus is fully occupied, then if 50 seats are provided 50 people will get on and 50 will get off during each mile. If the average delay caused is no more than two seconds per person, then we have a total delay of 200 seconds during each mile run. If the capacity were only 25 people, the delay would be halved, and the mile would be completed in one minute forty seconds less time. This represents an appreciable increase in speed. Moreover, if the volume of traffic to be handled is not very great, only a somewhat infrequent service can be justified if very capacious vehicles are employed. Suppose that the traffic justifies a 10-minute service of 50-seated vehicles or a 5 minute service of 25-seated vehicles, the latter is more convenient to the public, since the average wait at a stopping place before picking up a vehicle is only 2½ minutes instead of five minutes in the former case. The problem is thus to arrive at a correct compromise combining the lowest possible fares compatible with what the public regards as a sufficiently frequent and a sufficiently rapid service.

COUNTRY SERVICES.

In the case of the country omnibus service, the main reason why the tendency is rather in the direction of reducing the capacity of vehicles is, of course, that highway authorities wish to limit the total laden weight of vehicles using the roads regularly. In some cases strict limitation of dimensions is equally necessary on account of the roads being narrow, winding, or hilly. The considerations mentioned in the latter portion of the preceding paragraph must also be taken into account. A service on country roads is probably not in any case a very frequent one, and from the point of view of the public a half-hourly service of comparatively small vehicles is infinitely more convenient than an hourly service of vehicles double the size. Furthermore, the small vehicles are handier on country roads, and will therefore maintain an appreciably higher average speed without danger to the public. Up to a point people are willing to pay for speed and for convenience. The average passenger would rather spend an extra threepence than wait, say, twenty minutes longer for a conveyance. In considering all such questions as this, one has to remember that people's time is of value; cheap carriage is not the only consideration.

TAXI CAB FARES.

Just as some people will pay more for conveyance in a light but comparatively fast motor omnibus than in a large and comparatively slow one, so there are people whose time is of sufficient value to justify them in employing taxi-cabs rather than omnibuses. The taxi represents time saved and money spent in the process. The prospective passenger has to balance the saving of time against the expenditure of money, and it follows that if fares are unnecessarily high, the volume of custom will be decreased. The public naturally wishes the fares to be officially placed at the lowest possible figures. The taxi-cab proprietor, who may also be the driver, wishes to obtain the largest possible income from his vehicle. If he pushes fares up too high, he will defeat his own ends. If he puts

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them too low, he will fail to make a profit. The fares are regulated by the local authority, which must primarily consider the interests of the public, but in doing so must remember that those interests will not be served by making the provision of taxi-cabs unremunerative, and therefore leading to the withdrawal of such facilities. The taxi-cab proprietor must be given a reasonable margin of profit. An inquiry is now in progress in London on the question whether fares—increased some time ago from eightpence to a shilling a mile—may not now be decreased again to eightpence, or at least to tenpence. Any such reduction is opposed by the labour interests concerned, and also by the small proprietor; that is to say, the owner-driver. It is argued that the margin of profit, even now, is inadequate, and that a fair number of men have recently withdrawn their cabs from service. This last is a double-edged argument. The withdrawal may be the result of failure or equally may be the result of a man having done so well out of the business as to enable him to retire or to invest his increased capital in something which he regards as a preferable occupation. We certainly do not think that any further increase in fares would lead to an improvement in the position of the cab owner or owner-driver. Costs have been dropping for some time past, in face of which a further increase would be much resented by the public. It is more difficult to say whether a decrease is feasible. It may be that for a time the margin of profit was cut too fine, and that, as some of the men's representatives argue, the cab-driver was only making an imaginary profit, inasmuch as he was not allowing for the depreciation in the value of his vehicle. In other words, he was living on capital. The total cost of operation per mile run, including depreciation, is probably just about eightpence. Assuming 25 per cent. to be waste mileage, a shilling a mile still leaves some margin of profit after allowing for depreciation and also assuming a complete absence of tips. The representatives of the men are inclined to complain that they are dependent on the charity of the public. In other words, their profit comes from tips rather than from legal fares. This may be an undesirable state of things, but it is so far established that it would probably be quite impossible to introduce a system involving increased fares and no tipping.

GRADES OF CABS.

One suggestion that has been tentatively put forward and is at least worthy of consideration is the possibility of licensing cabs in different grades to which different fares would be applicable. It is rather absurd to be charged as much for the use of a low-powered two-cylindered vehicle fifteen years old as for the use of a thoroughly up-to-date four-cylindered vehicle of adequate power, and, generally speaking, in first-class condition. The licensing authority might then license cabs in grades "one" and "two," the fare in the one case being, perhaps, a shilling a mile and in the other case eightpence or tenpence a mile. The cabs would either carry obvious distinguishing marks or else would be standardised in respect of colour, so that the public would know the legal fare chargeable in respect of any vehicle at a glance. So long as all fares are equal, the man who puts cabs upon the road is rather encouraged to buy the very cheapest thing that he can get licensed at all. Were the vehicles to be graded, he would be encouraged to put the best possible class of cab upon the road in order to ensure its being classified in the first grade and long remaining in that grade.

COMMERCIAL MOTORS AT THE ROYAL SHOW.

The 81st annual show of the Royal Agricultural Society of England was held at Cambridge from July 4 to 8, and was in every respect worthy of the high reputation of the Society. The total list of entries numbered 494, a figure largely in excess of that of any post-war year. All the usual classes were well supported with the one exception that in the vehicle section the usual fine display of petrol-driven machines was reduced to a small number of exhibits in consequence of the decision of the Society of Motor Manufacturers and Traders not to permit any but steam-driven vehicles.

Among the many exhibits of steam-driven machines were some exceptionally fine examples of traction engines, tractors, and wagons, which in the aggregate covered a wide field of usefulness. Amongst these may be noted the new 6-ton Foden steam wagon, two examples of which were staged, each being fitted with solid rubber tyres. In this model three speeds are arranged for, the final drive being by single roller chain, while the steering gear is of the Ackerman type. With its full load this machine does over 22 miles to the cwt. of coal at an average speed of 12 miles per hour.

Leyland Motors, Limited, also exhibited a 6-ton wagon of their standard undertype model. This is fitted with a superheating coil, and has a working pressure of 250 lb. per square inch. It has a two-speed gear, the final drive being by chain. The novelty in this section was undoubtedly the new Yorkshire steam wagon chassis exhibited by the Yorkshire Patent Steam Wagon Company, of Leeds. With the exception of the double-ended loco-type boiler, which has always been a familiar feature of the Yorkshire steam wagons, the new model represents a radical departure from standard practice. The vertical compound balanced type of engine has all the working parts enclosed in an oil-tight casing, a bye-pass valve being fitted to admit high pressure steam to the low pressure cylinder. Three speeds are provided for, the power being transmitted to the road wheels by means of spring shafts from the differential gear and enclosed cardan shaft. The final drive is by means of a bevel and spur double reduction gear. A patent ratchet brake of a most powerful type acts upon the rear wheels.

Richard Garrett and Sons, Limited, included in their exhibit one of their new 6-ton undertype superheated steam wagons. This has a totally enclosed engine.

Ransomes, Sims and Jefferies, in an exceptionally fine exhibit, staged their new combination for converting a four-wheel platform steam wagon into a six-wheeler of large carrying capacity. This represents an entirely new departure in the design of this class of vehicle, many advantages being claimed for its use. As a new implement it had been entered for the R.A.S. silver medal. A number of all-steel trailers, both of the fixed and tipping variety, were shown. Messrs. Fodens staged one of the former fitted with brakes of the contracting type operating on drums mounted on the rear wheels, which were of cast-steel on solid rubber tyres. The Eagle Engineering Company, Limited, exhibited a hand tipping trailer of their well-known design amongst many other exhibits which were of exceptional interest. Of the few petrol-driven vehicles shown the most interesting was undoubtedly the "Busvan," staged by Henry Garner, Limited. As the name indicates, the vehicle can be used as an omnibus or van at will. As the former it has seating accommodation for 22 passengers on cross seats fitted with springs and padded backs. When required as a van, the seats are folded to the side of the vehicle, where they occupy very little space, the whole operation only occupying a few moments. The entrance is at the front, so that the driver can control the entrance and exit of the passengers and collect the fares. Other exhibits on this stand were a general purpose lorry and a milk carrying lorry.

A novel vehicle designed for the carriage of horses by road was shown by a firm of coachbuilders—Messrs. Dennis, of Kensington. This was mounted on a 4-ton "J" type Thornycroft chassis. Vehicles were also shown by Slough Lorries and Components, Limited, Maxwell Motors Limited, and The International Harvester Company of Great Britain, while Messrs. Dennis Brothers, of Guildford, exhibited one of their standard fire pumps unmounted.

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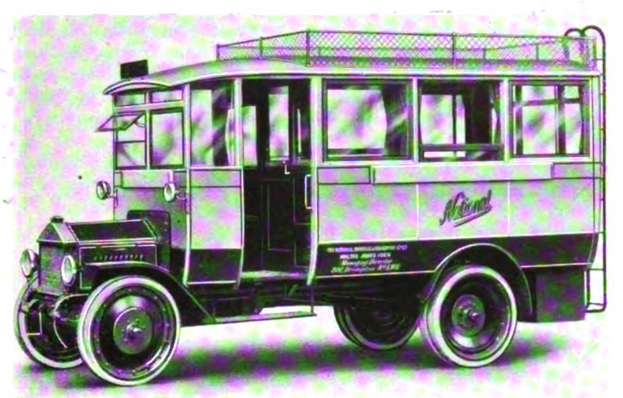
"NATIONAL" ONE-MAN OMNIBUSES.

FIFTEEN-SEAT CUSHION-TYRED VEHICLE WITH SPEED OF 20 MILES PER HOUR.

Our illustrations show the near and off side views of one of the new type omnibuses recently constructed by the Hickman Body Building Company, Limited, of 8, Grove Road, Balham, London, to the order of the National Omnibus and Transport Company, Limited, for service at Taunton, Colchester, and Chelmsford. In common with a number of omnibus operating authorities, the National Company



New Hickman One-Man Body on Burford Chassis.

have found it advisable to supplement their fleets of larger capacity vehicles with a number of smaller machines capable of use for special or private purposes and at the same time efficient for service where light traffic would not justify the use of the larger units, or the roads are unsuitable for heavy vehicles. These machines have seating for 15 passengers, and apart from the fact that only one man is required to run them in regular service, their outstanding feature is their light weight.

The bodies are mounted on a 30-cwt. Burford chassis, and the total weight without any allowances for petrol and water is only 46 cwts., including a large locker placed underneath the chassis at the rear, luggage rails and iron ladder. As this weight under the proposed new schedule will give these vehicles a legal speed of 20 miles per hour, their sphere of usefulness is very wide, while the cost of running and maintenance is extremely low. The light weight of the bodies has been obtained by the reduction of all body scantlings to a minimum, but, by the scientific method of construction, together with the use of light steel castings in place of the usual heavy forgings, a sound, practical body has been produced, for which a long life is anticipated.

As will be seen from the illustrations the bodies have a deep D front glazed above the waist rail, and a full front frame in front of the driver with a screen to open on heavy brass quadrants. The upper part of the off side of the driver is open between the back of the D front and the framing of the interior to enable the driver to signal to oncoming traffic. The lower part is enclosed, a narrow door being fitted for the driver's use. On the near side a wide entrance is provided for the passengers. This arrangement is particularly easy by reason of the fact that the Burford chassis has a low frame, and full advantage has been taken of this to keep the floor of the body close to the chassis. Only one step is required to give access.

Passengers are completely protected from the weather and from interfering with the driver by a full partition and sliding door across the body at the back of the driver. This partition and sliding door is framed in Honduras mahogany, glazed above the waist rail. The door is suspended on a ball bearing runner bar at the top and guide rail at the bottom, with rubber rollers mounted on brass plates at the centre to prevent knocking between the door and enclosing partition. A heavy hook lock is fitted to act both as a lock and handle for the manipulation of the door. The seating plan is arranged to seat seven passengers on longitudinal seats on each side of the body, with a seat fixed to an emergency door at the rear end of the body. These have comfortable spring cushions with deep spring back pads. The emergency door is fitted with bolts operating at the top and bottom of the door, the operating lever at the centre inside and outside having an aluminium plate indicating the direction in which it should be moved to open the door. A safety bar is also fitted inside in order to prevent accidents.

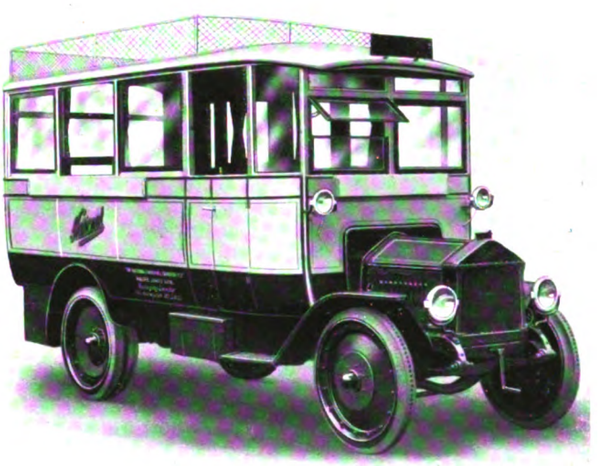
DISTINCTIVE FEATURES OF THE CHASSIS.

A feature rarely found in this type of small capacity omnibus is the ample head room. This is 5 ft. 11 in. clear between the top of the floor slats to the underside of the hoop sticks. Longitudinal hand rails are provided; it is thus possible to accommodate a number of standing passengers with comfort during peak load periods.

Drop windows are fitted of an entirely new type, and in this connection Messrs. Hickman claim to have overcome the difficulties hitherto encountered in the search for a rattleproof window of simple construction suitable for a public service vehicle. These windows, for which a patent is being sought, are mounted in mahogany frames, and drop into a channel below the waist rail only, the frame above the rail being secured at any desired height. The windows are of the balanced pattern, easy of manipulation, and inexpensive to install, while the cost of maintenance should compare most favourably with any other type.

The illustrations show that the general appearance is on most attractive lines, notwithstanding the shortness of the body in comparison with its height; in fact it is not too much to say that the design favours high class carriage work rather than that usually associated with commercial vehicles. The Burford 30-cwt. chassis has the merit of being exceptionally light in weight for its power, while the long wide road springs, giving a high degree of flexibility, render it admirably suited for passenger service. The lightness of the chassis is due to the use of high grade steels specially selected for each of the component parts. The nickel steel frame is exceptionally strong and allows for the excessive strain of heavy loads being continually carried over bad roads, while powerful independent brakes render the vehicle safe on any gradient.

The engine, which develops 23 H.P. at its normal speed, is built up with the gear box and clutch as a complete unit. It can easily be taken from the chassis for overhaul, and is attached to the frame by three point suspension. The change speed and service brake levers are in the centre, the gear box being designed for three speeds and a reverse. All gears are of chrome nickel steel, heat treated, and run on ball bearings. It is claimed for the Burford back axle that it is lighter, stronger and more efficient mechanically than other



Offside View of the Attractive Hickman-Burford Omnibus.

forms of transmission. The unit consists of a separate forged steel axle to take the load, and immediately behind are the differential shafts for transmitting the driving torque. The final drive is by internal gear ring and pinion, giving a total reduction of 7 to 1. All working parts are enclosed and can be efficiently lubricated without any trouble.

It is worthy of note that Messrs. Burford and Company have designed a complete oil chart, which not only indicates the points which require attention, but the nature and frequency of the

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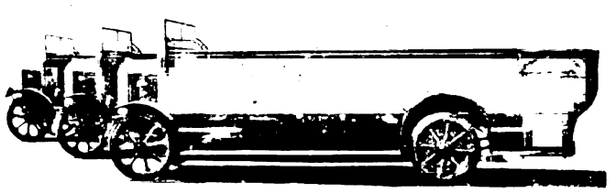
lubrication required. This chart also gives both in plan and elevation the lay out of the chassis.

All the omnibuses of this type are fitted with Macintosh "N.A.P." tyres, for which is claimed the cushioning effects of pneumatics with the durability of solids; it will therefore be seen that every care has been taken by the National Company to provide a public service vehicle that shall give the maximum degree of comfort for the passenger at the least possible expense to the highway authorities in the matter of road maintenance.

STRAKER-SQUIRE LATEST COACH.

The three vehicles illustrated on this page, bearing the name of East London Coaches, were lately delivered to the East London Motors, Limited, 52 Cambridge Road, Mile End, E., by Messrs. Straker-Squire, Limited, of Edmonton. In placing this order for conveyances to be used in their service to the East Coast, the company were guided by their experience of Straker-Squire machines for some time past. The new vehicles are of the latest type, and are luxuriously furnished. Seats are provided for 25 passengers. Five persons are seated at the rear over a commodious luggage receptacle, the remainder of the seats being of the armchair pattern, arranged in four rows on each side of the gangway. All the seats are the acme of comfort, which is secured by excellent springing and upholstering in leather. At the back of each seat a rug rail is fitted. Provision against rain is afforded by side curtains of a rigid type,



Straker-Squire 25-Seat Coaches with Luxurious Fittings.

which can be attached to the hood when in use. A convenience much appreciated by long distance passengers is seen in the collapsible tables between the back seat and the rear row of the armchair seats. The windscreen is divisible, and each of the top halves can be opened. The body is decorated in blue, with gilt lettering in bold characters that constitute a first-class advertisement. C. A. V. electric lighting serves for both the headlights and the interior.

B.E.T. OMNIBUS SERVICES.

THEIR UTILITY TO THE TRAMWAYS.

Mr. J. S. Austen, chairman of the British Electric Traction Company, speaking at the 26th annual meeting, made the following reference to the omnibus business of the company—"By omnibuses I do not mean coaches, which are an entirely different business, but omnibuses which traverse specified routes at fixed times, mainly in rural districts, or link up towns. The country is covered by a network of these routes. This business to be profitable must be conducted by men thoroughly conversant with it, but above all it is one which must be conducted by large companies. It is only large companies that can adapt their services to the varying exigencies of the moment. The profits are not such as will stand much competition, and in this respect I am inclined to think that we have not got very much to fear, because, as you know, all these omnibuses have to be licensed by the local authorities, and omnibuses wear out the roads. I cannot imagine that they are going to allow more omnibuses to go on wearing out their roads than the necessities and the convenience of the public require. Our direct interest in the omnibuses is mainly derived through the British Automobile Traction Company, but in addition we have a very large omnibus interest derived through our tramway companies. A large number combine omnibuses with their tramways, partly for the purpose of feeding their tramways and also with the object of preventing competition. In many cases this is a very valuable adjunct to the tramways. Our interest in the omnibus business is likely to increase, as it is one which is capable of expansion."

DONCASTER OMNIBUS PROPOSALS.

The unopposed Bill of the Corporation came before a House of Commons Committee on June 29, it having already passed the House of Lords. Powers were sought to provide and operate omnibus services to five outlying places in order to provide for traffic created by coalfield development. Counsel stated that in normal times the Corporation would have constructed tramways, and Mr. T. Potts, general manager of the tramways and omnibus department, said it was estimated that all the routes could be worked remuneratively. It was proposed to spend £15,300 on omnibuses, and £4,700 for buildings and equipment. The new routes would provide for miners who now had to travel by train and then walk a mile or more to the colliery. No difficulty was experienced in using the same vehicles for other passengers besides the miners. In the past any difficulty had been avoided by using removable cushions. The Tramways Committee had not yet decided upon the make of vehicle to be used. The Bill was sent for report and third reading.

TRAINING OF PUPILS AND APPRENTICES.

For a number of years the training of pupils and apprentices has received the serious consideration of John I. Thornycroft and Company, Ltd., and in this connection they have in operation a highly satisfactory system which, they claim, has eliminated most of the difficulties hitherto encountered in the education of students for both the mechanical and administrative sides of an engineering works. The success of this system lies in the fact that the theoretical and practical trainings run concurrently during the working day, thereby giving the student the benefit of access to the wide and varied experience of the works' staff, and also enabling him to understand the "reason why" of his work in the shops, whilst eliminating the necessity for study when in a tired, non-receptive condition after a day's work. Another important item in the system is that the students are graded according to ability in small classes, thereby ensuring individual attention and an even rate of progress.

Testimony to the efficiency of the scheme is afforded by the following gratifying results at the recent examination of the Institute of Mechanical Engineers, at which the undermentioned 11 pupils and apprentices passed the graduateship stage—J. A. G. Bowen, J. R. Cleave, B. M. Grace-White, W. H. Julian, R. V. Knowles, B. C. Oldham, J. R. Pearson, A. E. Read, A. J. Romer, J. F. Rose, and G. M. B. Small. R. W. Long passed the Associate Membership examination of the same institution.

HEAVY MOTORS AND RURAL ROADS.—An application by the Hants County Council to prohibit the use by heavy motor vehicles of about 30 or 40 specified roads in rural districts was the subject of an inquiry by the Transport Ministry. The principal grounds of the application were that the roads are too narrow and altogether unsuitable for heavy traffic, that to use them for this purpose was dangerous to other users, and that the cost of the excessive wear and tear falls entirely on the local rates. Opposition to the application came from motor coach owners and others, who said that such a prohibition would have considerable effect on trips to the New Forest, etc.

COACH RESTRICTIONS IN LAKELAND.—The Ministry of Transport have informed Westmorland County Council of their decision on the application to close 25 roads in the county to heavy motor traffic. They have refused an order for the closing of the road through the Lyth Valley to Windermere. This road, the Ministry state, must be kept open for all traffic. For that purpose a sum of £12,000 should be spent on it, towards which they would be prepared to pay one-half. With regard to the other roads, the Ministry had decided to issue an order, restricting the use of some of the roads to vehicles less than three tons and carrying 20 passengers inclusive of the driver, and of the others to vehicles carrying not more than 14 passengers. Warning boards must be put at every entrance to each of the highways affected, and the Ministry must receive an intimation that such notices were ready for erection before issuing the order. The cost of these notices to the Council is estimated at £462, there being as many as 17 required on some of the roads.

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"SERVICE" ON THE ROAD.

USEFUL FLEET OF THE A.E.C.

Users of commercial motor vehicles of all types are coming to appreciate more and more the value of efficient "service" rendered by the manufacturers of their vehicles when these are out on the road. There is an erroneous impression in many quarters that it is only the representative of the foreign manufacturer who pays sufficient attention to this important matter. In point of fact there is probably no firm, British or foreign, which gives more practical consideration to the problem of how best to afford service to the user than the Associated Equipment Company, of Walthamstow. This firm has on the road a fleet of service lorries by the aid of which its travelling inspectors are enabled to be of far more substantial assistance to users than would otherwise be possible. Not only are periodic calls made upon users at their own premises, but A.E.C. service lorries are also in attendance wherever public service motor vehicles come together in large numbers. The use of motor coaches and omnibuses for carrying people to the more popular race meetings is now becoming so general that it is almost inevitable that the drivers of some of these vehicles will be glad to avail themselves of some slight expert assistance before starting the return journey. The troubles may be small ones which may not amount to positive breakdowns, and the work to be done may be more in the nature of a precaution. Nevertheless, it is useful so far as it eliminates the possibilities of a breakdown before arrival home.

Thus, for instance, at Epsom this year there were on an average 150 A.E.C. vehicles—not counting the L.G.O.C. omnibuses—present on each day. These were supported by two service lorries, the presence of which was much appreciated by A.E.C. owners, although very little mechanical trouble was experienced. The utility of the service vehicle is becoming more and more marked with the prevailing tendency of owners to employ drivers who are merely steersmen and possess no mechanical knowledge. Both at Epsom and at Ascot the inspectors in charge of the A.E.C. lorries did not adopt the selfish policy of giving attention to their own firm's clients only, but also undertook much work on vehicles of various other makes. Magneto repairs, inefficient brakes, and broken petrol pipes are found to be among the more common forms of trouble requiring attention.

TAXATION OF MECHANICALLY-PROPELLED ROAD VEHICLES.

DEPARTMENTAL COMMITTEE INVITE SUGGESTIONS.

The Departmental Committee on the Taxation and Regulation of Road Vehicles propose shortly to commence their inquiry into the question of the taxation of mechanically propelled road vehicles. The committee have decided to confine their attention for the present to the investigation of alternative methods of taxation, leaving the question of incidence of tax to be dealt with later.

Suggestions are invited through motoring or other organisations for alternative methods of taxation to that at present in operation, which will produce a gross annual sum of approximately £10,250,000, exclusive of receipts in respect of licences for horse-drawn vehicles, fees for drivers' licences, and penalties for offences. It is essential that all schemes submitted should be restricted to definite *methods* of taxation only. They should show precisely the proposed method or methods, and should be accompanied by a detailed estimate of the receipts therefrom, both gross and net. The administrative difficulties in connection with, and the cost of, collection of duties in respect of mechanically propelled vehicles are of great importance, and any scheme submitted should be accompanied by a memorandum showing the proposed method of collection. The present approximate costs of collection, including registration of vehicles and the issue of drivers' licences, is £350,000 per annum. Any increase in this figure under any alternative system will, of course, necessitate a compensating increase in the gross receipts.

Communications should be sent to Mr. S. J. Pool Godsell, secretary of the committee, at the Ministry of Transport, 7 Whitehall Gardens, S.W.1, by September 1 next.

SIR DUGALD CLERK has been presented with the Albert Medal of the Royal Society of Arts in "recognition of his important contributions, both theoretical and practical, to the development of the internal combustion engine."

A.E.C. LORRIES FOR WILD BEASTS.

Recently a consignment of wild beasts was despatched from India to New York. It consisted of 697 monkeys, 6,500 birds, 100 pythons and a large assortment of deer and bears. A.E.C. lorries owned by the Walford Transport, Limited, were employed for conveying the live stock to the ship, and the appended photograph shows one of the loads.

THE FITNESS OF OMNIBUSES.

Bridlington Corporation have been in communication with the Ministry of Transport with reference to the standard of fitness of omnibuses to be required by licensing authorities. The Ministry state that so far as they are aware no memorandum has been issued with regard to the matter, and suggesting that when the Council were dealing with applications for licences in respect of vehicles to ply for hire, they should in the first place satisfy themselves that the vehicles complied with the statutory requirements as to construction, and, having done this, should exercise the discretion vested in them by the Towns Police Clauses Acts, 1847 and 1889, to secure that the vehicles licensed were those which in their opinion

Transporting a "Zoo" on A.E.C. Lorries.

were best constructed to secure the safety and convenience of the passengers, and in other ways to meet the particular requirements of the borough.

The Corporation have decided to communicate with the East Riding County Council and other authorities on the question of the inspection of vehicles.

Meanwhile it has been decided that no licences be granted authorising omnibuses to ply for hire until the vehicles have been inspected and approved, and until the proprietors undertake in writing to comply with the reasonable requirements of the Corporation, and submit time tables, lists of fares, and stopping places, which will be strictly adhered to, for the approval of the Corporation.

BRIGHTON AQUARIUM AS A COACH STATION.—By 28 votes to 20 the Brighton Town Council on June 29 decided to lease the Aquarium to the Southdown Motor Services, Limited, for the construction of a coach garage with ornamental roof, refreshment and entertainment rooms, etc., at a rental of £2,870 per annum. The company undertake to spend £40,000 on the building.

ELECTRIC VEHICLE PROGRESS.—The annual report of the Institution of Municipal and County Engineers makes reference to a report presented by Mr. N. Scorgie, their representative on the Electric Vehicle Committee. The activities of the committee, Mr. Scorgie states, had been mainly centred during the past year upon propaganda work. Further consideration had been given to the question of forming an Electric Vehicle Association, but as the time was not opportune the proposal remained in abeyance. Electricity supply undertakings had been asked to provide charging facilities where not at present existing.

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MOTOR TRAFFIC

"THE CHARABUS."

A Body for All-the-Year Use.

The main idea of Messrs. C. Dodson, Limited, in designing the "charabus" was to produce an improvement on the motor coach by providing an open type of vehicle that is readily made so comfortable and weatherproof that it can be used in any weather and all the year round. The standard cape cart hood as used on large vehicles is far from satisfactory in bad weather. Passengers often get wet while it is being raised, and the difficulty of its operation makes the men in charge avoid raising or lowering the hood as much as they possibly can, whereas with the "charabus" a man single-handed can easily give the passengers cover from rain in less than one minute.

Two men can in ten minutes convert the "charabus" from an open vehicle to one closed and as comfortable, well ventilated, and cheerful as regards view as a first-class saloon omnibus, with the additional feature of having a well illuminated interior for travelling after dark. Should the weather be only showery, storm curtains which are provided can be advantageously used, so that the body can be quickly opened out again as the weather improves.

Many coach proprietors will attach considerable value to the fact that the "charabus" can be used when desired as a service or private omnibus, the access to the interior and all the seats being quite easy both from the fore and aft doors. The usual coach type of body is very unsuitable for this purpose, owing to its construction making the seats difficult of access, and also to the absence of protection of passengers against cold and wet weather.

The view from the interior of the "charabus" is not materially restricted by the construction. The permanent rear compartment has the advantage of protecting the passengers from following dust, while the driver's permanent cab acts as a window-screen. The "charabus" has such obvious features making for the comfort and pleasure of passengers, principally from assured protection from inclement weather, that there is very little doubt as to its ultimate popularity, and it is fair to assume that the "charabus" will be patronised under uncertain weather conditions when an ordinary coach might very well be regarded with disfavour or doubt. Upon fairly long trips returning late at night, the air, even in summer, becomes chilly, and the ride tedious owing to cold and darkness; but with the "charabus" closed and the interior lit up, a cheerful and pleasant finish to the day's outing is assured.

"The Charabus" as constructed by Messrs. Christopher Dodson, Limited.

Poplar Borough Council have arranged to convert a much worn Lacre motor sweeper into a light runabout for the carriage of materials, and have arranged for a month's trial of a new motor sweeping machine.

MOTOR VEHICLES FOR MUNICIPALITIES.

St. Pancras Works Committee recommend the purchase of two more electric vehicles for refuse collection.

Calcutta Municipal Council have purchased eight Clayton electric 5-ton lorries for 15,340 rupees (at 1s. 4d. a rupee).

Worthing Corporation have decided to purchase a standard Ford chassis, fitted with a patent van ambulance body, at a cost of £291 10s.

Hampshire Standing Joint Committee have reported that as the horses and traps become worn out the police superintendents will be supplied with motor cars.

Sydney (N.S.W.) Municipal Council, who have ordered a Karrier street sweeping machine at a cost of £2,600, are applying to the Customs for the remission of the Customs duty on the machine.

Halifax Haulage Committee recommend the purchase of two 30-cwt. Vulcan chassis for £445 each; a 30-cwt. Vulcan hydraulic tipping wagon for £605; and two Ford tipping wagons for £240 each.

Willesden Urban Council have had tenders for the supply of a motor fire engine, but deferred consideration pending an interview with the chief officer of the London County Council Fire Brigade, with a view to obtaining certain information.

Camberwell Borough Council have been informed that the use for three months of a Sentinel steam wagon has effected a saving of £239. The Council have decided to purchase another Sentinel wagon, a motor road sweeper, a motor water van, and a motor lorry.

Glasgow Corporation Electricity Committee recommend the purchase of a 2-ton Garrett electrical demonstration motor vehicle, which the department has had on trial, at the price of £500. The Corporation are to purchase a light motor lorry for the Parks Department.

London Fire Brigade Committee have accepted the tender of Clement Talbot, Limited, at £2,380 for the supply of four petrol ambulances. The other tenders were as follow—Fiat Motors, £1,748; Keith and Boyle (London), (Guys), £1,860; Vulcan Motors (London), £2,236; Crossley Motors, £2,600; Albion Motor Car Company, £2,944.

Messrs. J. I. Thornycroft, Limited, have received orders for two B.T. type 2-ton tipping wagons for the Dumbarton County Council, three J type 4-ton tipping wagons for the Derbyshire County Council, two J type chassis for Shanghai Municipal Council, and three B.T. type 2-ton chassis for the Crown Agents for the Colonies on behalf of the Kuala Lumpur Sanitary Board.

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MOTOR TRAFFIC

GOODRICH SEMI-PNEUMATIC TYRE.

A new pattern tyre has just been placed upon the market by the B. F. Goodrich Rubber Company, for which is claimed much of the resiliency of pneumatics without any of the limitations attendant upon their use with heavy commercial vehicles. As shown in the illustration of a cross section of the tyre, a deep groove or air chamber is formed in the base of the tyre, the steel retaining ring being also cut to correspond. In practice this form provides room for the tyre to "give" when passing over projections, and to absorb jolts and jars which would otherwise be transmitted to the chassis of the vehicle. The extra high tread of wear-resisting rubber insures a full measure of service, while the groove in the centre of

the tread reduces skidding to a minimum. Side blocks are also incorporated in the design of the tread for the purpose of providing the maximum traction surface consistent with the non-skid properties of the tyre.

We are informed that severe tests under all operating conditions have proved that these tyres make it possible for higher average speeds, consequently greater mileage for the vehicle, prevent breakages with fragile loads, and reduces the maintenance costs. These tyres are made to fit all standard wheels, and can be pressed on in the usual manner.

A further advantage claimed for these tyres is that the resiliency actually increased with wear, as the reduced thickness of the tread permits greater movement.

OMNIBUS SERVICES.

BIRKENHEAD.—The Corporation have been negotiating with the Bebington and Bromborough Urban Council with regard to the running by the Corporation of a service to Bromborough.

BRANDON.—The Urban Council have requested the North Eastern Railway Company to adhere to the omnibus time tables in the interests of the general community and from the standpoint of safety. The company had complained that the schedule prevented them giving better facilities where a change of time was advantageous.

CARDIFF.—On the suggestion of Mr. H. L. Horsfield, general manager of the tramways and omnibuses, the Tramways Committee have decided to obtain a small type of omnibus for the Penylan route, to hold 16 persons, the driver also to act as conductor. The revenue from the whole of the omnibuses for the period April 1 to June 17 was £2,726, an increase of £284. The vehicles are now paying the running costs, but there is no surplus for capital charges. Mr. R. L. Horsfield reported to the committee on June 26 that in connection with the taking over of the Whitchurch motor omnibus service it had been agreed to pay the Cardiff Tramways Company, the vendors, £6,000 for their land and buildings at Llandaff North. The Corporation are not taking over the company's vehicles, and the Tramways Committee decided to invite tenders for new omnibuses for this service. It was also decided to apply for sanction to borrow £6,120, with an additional £200, for certain fixtures and machinery at the company's depot.

CHESTERFIELD.—In the Bill to be promoted in Parliament the Tramways Committee have decided to ask for power to lease their motor omnibus powers. Additional powers are asked for the running of omnibuses to Bakewell, Baslow, New Brimington, Barrow Hill, and Eckington, and along Storforth Lane to form a circular route between Chesterfield, Birdholme, Hasland, and Chesterfield. The Temple Normanton route is to be extended to Holmewood. The routes at present authorised for railless traction are to be abandoned, and in lieu thereof power be taken if necessary to convert the existing tramway system to railless trolley traction.

EDINBURGH.—The Tramways Sub-committee recommend the adoption of pneumatic tyres for six of the Corporation motor omnibuses.

LINCOLN.—On the first complete year's working of the omnibus section of the Lincoln Corporation Tramways the trading profit was £1,303. Sinking fund and interest charges amounted to £4,439, leaving a deficiency of £3,136 to be met by the borough rate.

LIVERPOOL.—It is stated in the annual report of Mr. Priestly, general manager of the Tramways Department, that the omnibuses have been withdrawn from routes on which they had been used in helping to carry the vast numbers of passengers in 1919 and 1920, while the stock of tramcars was depleted. Omnibuses are now used to connect up the outlying suburbs and in meeting extraordinary traffic.

LONDON.—By the end of October the L.G.O.C. will put in service 380 additional S type omnibuses. As each vehicle will seat 54 passengers, there will be accommodation for 20,000 persons. A considerable number of the B type machines will be withdrawn. It is estimated that nearly 4,000,000 passengers were carried by the omnibuses on Whit-Monday. Three thousand vehicles were in use. A feature of the country route services was the large number of rural people who travelled by omnibus to London.

MANCHESTER.—On July 1 a new omnibus service was inaugurated by the Tramways Department from Chorlton Station to Edge Lane, near Longford Park, Stretford.

NEWPORT.—Proprietors of omnibuses running into Newport have appealed to the Ministry of Transport against a by-law enacted by the Corporation to prevent coaches and omnibuses plying for hire on Sundays before 1 p.m. The Ministry had previously requested the Council to grant full licences, but they replied that the tramways did not start running until 1 p.m.

NUNEATON.—The Council have refused eight applications for omnibus licences on the ground that on the routes applied for a reliable service already exists. The Birmingham and Midland Company have promised "as far as possible" to comply with the Council's request for workmen's fares and penny stages.

ROTHERHAM.—As wages for Sunday labour have now been reduced from time and a half to time and a quarter, the Corporation have decided to run omnibus services on all routes.

TODMORDEN.—The working of the municipal omnibuses during the past year shows a balance of £85. The number of passengers increased 22 per cent.

WARRINGTON.—The Watch Committee have sanctioned a service by the Crosville Motor Company from Warrington to Widnes, and a service by the Altrincham Motor Services, Limited, between Lymm, Stockton Heath, and Warrington.

WALSALL.—The Corporation accounts show a loss of £3,654 on the motor omnibus undertaking.

WOLVERHAMPTON.—Sedgley Urban Council have accepted an offer by Wolverhampton Corporation of 2d. per omnibus-mile for an omnibus service over roads for which the first-named Council are responsible. Consent has been given for twelve months.

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MOTOR TRAFFIC

MOTOR TRAFFIC NOTES.

East Ham Municipal Garage.—East Ham Corporation have prepared a scheme, to cost £10,000, for a central garage and stores.

Church Army Transport.—An anonymous donor has presented the Church Army with the complete cost of a second motor mission van for use at fairs, market places, and on racecourses.

Rotherham Highways Committee are to have a three weeks' trial of a Lacre motor sweeper offered for sale at £460 by Halifax Corporation. They have authorised the engineer to purchase if the vehicle is satisfactory.

Pneumatics for Heavy Vehicles.—At the annual conference of the Urban Councils Association, a resolution was passed urging that heavy motor vehicles should be required by law to be furnished with pneumatic or other soft tyres.

Local Authorities and Omnibus Regulation.—A sub-committee has been appointed by the Association of Municipal Corporations to consider and report on the powers which a local authority should have for the regulation of omnibuses.

Name Plates for Conductors.—In place of a number-plate the conductors of the New York Fifth Avenue Omnibus Company now wear a plate on the left breast pocket giving their names in full. The innovation is intended to mark the status of the conductor as a salesman of transportation.

International Road Congress.—The fourth International Road Congress will be held at Seville in May 1923. A meeting of representative British organisations was held on June 26 at the Ministry of Transport, when a British committee was formed, with headquarters at 15 Dartmouth Street, S.W.1.

Tramway and Omnibus Competition.—At Halifax Corporation Tramways Committee, the manager (Mr. B. Hall) reported on the omnibus competition with the tramways on the Sowerby Bridge and Triangle section, and the Town Clerk was instructed to interview the Clerk to the Sowerby Bridge Urban Council on the matter.

Current for Electrics.—Glasgow Corporation Electricity Committee propose that the rate for electrical energy used for charging motor vehicles shall be 1½d. per unit, and that a rebate of ½d. per unit be made to proprietors of public garages who undertake to charge electric vehicles and to provide the necessary converting plant therefor.

The Price of Petrol.—Now that the price of petrol has remained for a year at 2s. 5½d. per gallon, motor owners are asking when a further reduction will be made. As a justification for a lower price they refer to the 27½ per cent. dividend paid by the Shell Company, and the fall in the prices of American crude oil and in Atlantic freights.

The Proposed Road Vehicles Bill.—Mr. A. Neal, Parliamentary Secretary of the Ministry of Transport, has announced that it will not be possible to introduce legislation this session on the report of the Departmental Committee recommending changes in the Motor Car Act and Regulations. Sir Wm. Joynson-Hicks, M.P., is of opinion that the Government should give facilities for the Bill during the autumn session.

To Avoid Central Manchester.—On June 22 the Town Planning Committee of Manchester had recorders at work taking note of the vehicles using the roads in the city and fifteen miles around it. The object of the census is to discover to what extent congestion of the central thoroughfares is due to vehicles driving through the city because there is no road round it. The recorders noted the place of origin of all vehicles passing through the city.

Refusal to Grant a Licence.—Chester Watch Committee refused to grant a licence to run a service of omnibuses two days a week from Holt to Chester, as the Chief Constable reported that there are already efficient services on this route. Mr. R. Roberts appealed to the Ministry of Transport against the refusal of the Chester Corporation to grant him a licence to ply for hire with omnibuses between Buckley and Chester, but the Ministry have disallowed the appeal.

Labour Party's President and Motor Cars.—In his address as president of the Labour Party's Conference held at Edinburgh on June 27, Mr. F. Jowett (Bradford) gave utterance to some crude ideas. One was a denunciation of the spending of two hundred millions a year on pleasure motoring. He demanded that it should cease at once. It would be interesting to hear the views of the trade unionists who are employed to build the cars, and of the men who drive them.

Preston Tramway Department's Leyland Omnibus.

Omnibuses During Tube Rebuilding.—In order to provide travelling facilities during the rebuilding of the first portion of the City and South London Electric Railway, the company have arranged for an omnibus service between Euston and Moorgate Street. The vehicles will be painted a distinctive colour, and will run above the route of the railway. Passengers will be picked up and set down only at the points where there are tube stations, namely, Old Street, City Road, Angel, King's Cross, and Euston.

Veto on Mileage Charges.—Recently the Chester Corporation decided to impose mileage charges in connection with an omnibus service along Canal Street and Garden Lane, contending that they had the power to impose such charges as a condition to licences to ply for hire. Now the Ministry of Transport writes to the Corporation that they cannot support the requirement, but pointing out that it is open for the Corporation to apply for a grant towards the reconstruction or strengthening of the road.

Lighter Omnibuses and Pneumatic Tyres.—The Roads Committee of the East Suffolk County Council report correspondence with the Eastern Counties Road Car Company with reference to the introduction of a lighter type of omnibus running on pneumatic tyres similar to some operating in one part of the county by the United Services, Limited. The company stated that they would consider the matter, adding that the small type of vehicle was being operated experimentally, and that in their opinion it was not of sufficient carrying capacity to make it a commercial proposition at popular fares. The United Services, Limited, had stated that their experiment with the light type of vehicle was not yet complete.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, AUGUST 24, 1922. VOL. LII.

WOLVERHAMPTON CORPORATION TRAMWAYS.

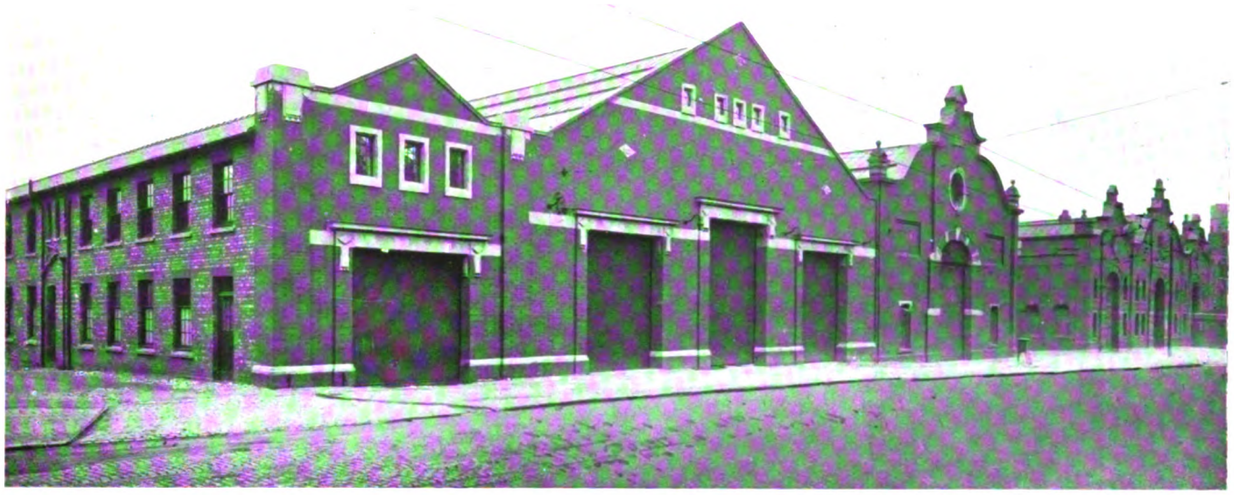
SOME NOTES ON RE-EQUIPMENT, DEPOT EXTENSIONS AND NEW ROLLING STOCK.

Important extensions to the depot and offices of Wolverhampton Corporation Tramways have recently been completed. This additional accommodation has been required for a long time, but the Tramways Committee, of which Alderman S. Craddock J.P. is chairman, were unable to proceed with the work during the war. The depot which is in Cleveland Road was last enlarged in 1913, when a new building with a site of 173 ft. by 60 ft. was erected, as described in our issue of June 11, 1914. The latest additions are west of and adjoining the 1913 extension, and cover an area of 185 ft. by 95 ft. In the accompanying illustration the two gables to the left and in the centre represent these extensions, while the ornamental facade adjoining on the right belongs to the pre-war addition. It will be realised, therefore, that with the older buildings shown in the distance, the Wolverhampton tramways, whose enterprising general manager and engineer is Mr. C. Owen Silvers, possess a headquarters of which they can feel justly proud.

The new buildings recently completed comprise the following sections—motor omnibus running shed, with paint shop and stores; administrative offices; men's recreation room and canteen.

The omnibus shed has dimensions of 110 ft. by 70 ft. At the rear of the running shed is a paint shop, in which tramcars are dealt with, and adjoining the paint shop is a general store, provided with an overhead gallery. On the west side are the administrative offices and a recreation room and canteen for the employees, to which there is a separate entrance.

The rolling stock of the Corporation tramways has been increased by the addition of four double-deck cars, with top covers, and eight single-deck cars. The latter have a wheel base of 8 ft. 6 in. and are equipped with Peckham pendulum trucks. They have a front exit door on the near side, under the control of the motorman, while to meet the requirements of the Ministry of Transport, side guards and folding steps were installed. An interesting feature of the interior design of these single-deck cars is that they have no partitions, the saloons being terminated in a completely enclosed vestibule. The power equipment is GE 60 motors, formerly in service on the double-deck cars, which are now fitted with a larger ventilated type. The renewal of the original motors on the ordinary rolling stock has, in fact, been proceeding for some time, and the GE 249 ventilated motor has been used since early in 1918.



Extensions of Wolverhampton Corporation Tramway and Motor Omnibus Depot.

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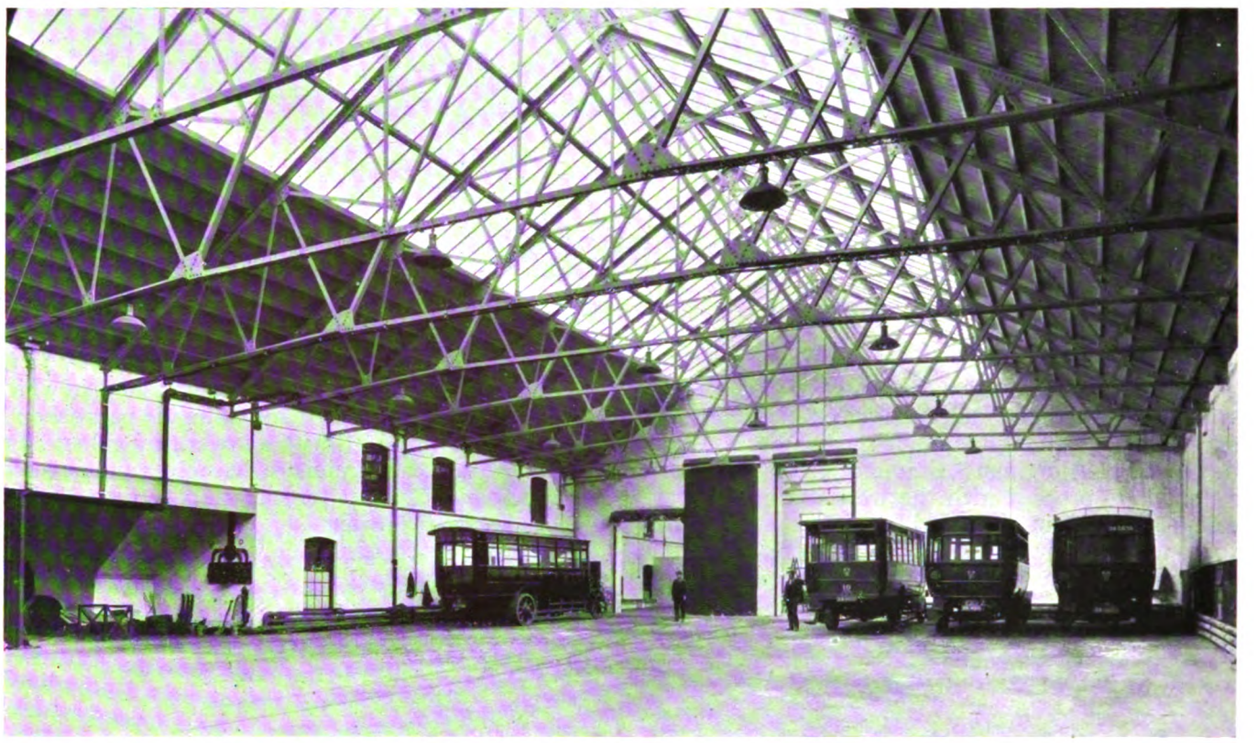
After nearly 20 years' successful running with the Lorain surface contact system, the time for reconstruction arrived, and after careful consideration the Tramways Committee decided to instal the overhead trolley system. The overhead construction was carried out by direct labour, under the direction of the engineer and manager, Mr. C. Owen Silvers. Span wire construction was used generally, with occasional resort to bracket arms. Weldless steel poles, made by the British Mannesman Tube Company Limited, of Newport and Swansea, have been adopted throughout, the light poles being specified slightly stronger than the British standard pole. Standard 4/0 gauge grooved trolley wire, and all standard fittings as adopted by the Municipal Tramways Association are in use, the overhead fittings being supplied by Alfred Wiseman Limited. There are 1,073 poles and 75 wall rosettes throughout the system. The cars have been wired for the overhead system, and fitted with Brecknell, Munro and Rogers trolley bases. The conversion was carried out without interfering with the traffic in any way, or causing inconvenience to the public, the 14 route miles being completed within nine months.



New Motor Omnibus Shed—Wolverhampton Corporation Tramways.

Several routes in Wolverhampton have single tracks with loops, and a system of automatic signals has been introduced by the manager, where it is not possible to see from loop to loop. These signals are proving very satisfactory.

Petrol-Electric Motor Omnibus Used by Wolverhampton Corporation Tramways Department.

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MOTOR OMNIBUS DEPARTMENT.

Motor omnibuses were first run by the Wolverhampton Corporation in 1905, when a service of Wolseley vehicles was operated on the Penn Fields Route. The borough therefore claims to be the second municipality to operate motor omnibuses, the first being Eastbourne in 1904. The rapid growth of the Penn Fields suburb, however, necessitated the establishment of a tramway service in 1909. In 1911 Albion omnibuses were put into operation on the Fallings Park route, which is now so popular that a five minutes' service is necessary on certain days of the week. During the war the Tilling-Stevens petrol-electric vehicle was adopted, and a fleet of 19 vehicles is now in operation. The standard type used has a Christopher Dodson single-deck body, seating 30 passengers, mounted on a Tilling-Stevens petrol electric chassis. In 1920 the Corporation obtained an Act of Parliament giving them power to operate omnibuses outside as well as inside the borough boundary. The specified route mileage is 58·379, the longest of these specified routes being the one between Wolverhampton and Bridgnorth, a distance of 13·7 miles. A successful service is also in operation between Cannock and Wolverhampton, a distance of nine miles. A 15 minutes' service is operated at busy times. Other services will be commenced with the completion of negotiations with the road authorities for adaptation.

Single Deck Car with Peckham Pendulum Truck of 8 ft. 6 in. Wheel Base.

Views of Single Deck Car Showing Front Entrance Open and Closed.

The Committee and the management devote much

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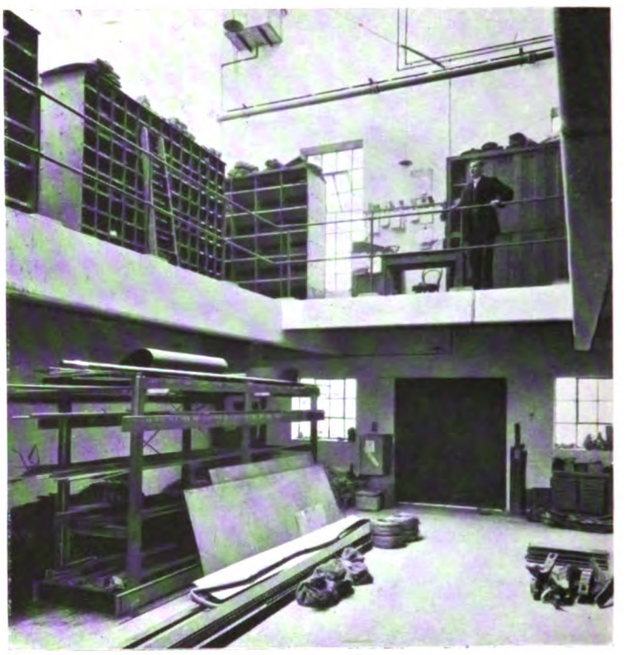
attention to social welfare of the employees. There is a flourishing men's recreation club which now has several branches. The men maintain a full orchestral band and a string quartette which is in the embryo stage. There is also a football team and a fishing club.

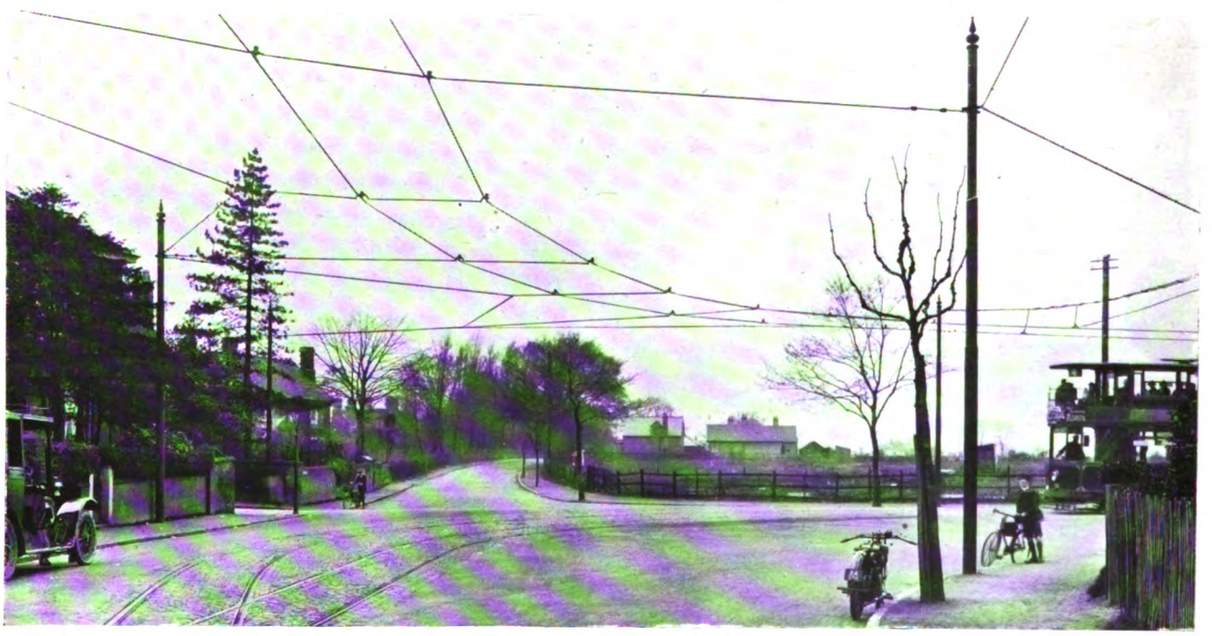
In conclusion it may be mentioned that the Wolverhampton Tramway and Motor Omnibus Department has up to the present consistently paid its way, and in addition has contributed considerable amounts to the relief of the rates. For the last financial year, which ended on March 31, 1922, there was a gross profit on the joint undertaking of £29,861, made up of £26,679 from the tramways and £3,182 from the omnibuses. From this total it has been possible to add nearly £7,600 to the reserve and renewals fund, which now stands at £33,548. For the year ended March 1921, the tramways made a gross profit (after providing for tax) of £15,329 and the omnibuses £781. The tramways consist of 22 miles of single track, and the mileage run last year was 1,255,827, the omnibuses covering 394,781 miles. Over 18 million passengers were carried by the combined systems. The tramways department have 66 cars and 19 omnibuses, and the average working expenses per car mile, including power cost, are 18.042d. and 16.461d. respectively. The average traffic revenue per car mile is 22.936d. on the tramways and 21.453d. on the omnibuses, while the respective percentages of working expenses to total revenue are 77.96 and 76.67.

Span Wire Construction at Wolverhampton.



Portion of Store Room—Wolverhampton Tramways.

The gross capital expenditure on the tramways up to March 31 last was £381,045, the corresponding figure for the omnibus system being £20,585. In the year 1919 a sum of £10,000 was contributed to the relief of the local rates, and in the previous year £6,580 was handed over. A total of £50,220 from the sinking fund, etc. has been applied in reduction of debt and the amount of this fund now in hand unapplied is £58,265.



Overhead Construction at Curve—Wolverhampton Corporation Tramways.

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ROAD MAINTENANCE AND TAXATION.

By E. S. Rayner, M.I.E.E., M. Inst.T.
General Manager and Engineer, Hull City Tramways.

Reconstruction, economy and the elimination of waste and overlapping being the order of the day, it is essential that the problem of road maintenance and the fair distribution of taxation levied on that account shall be solved.

Who is to pay for the reconstruction and maintenance of our roads? Is the user of the roads to pay or is the ratepayer to have the privilege?

The revolution in transport of the last few years has entirely changed the conditions which existed as recently as seven years ago when the number of heavy commercial vehicles and coaches using the roads outside the thickly populated areas was negligible.

To-day, the condition of the roads proves, without argument, that the enormous increase in the number of commercial motor vehicles has enhanced the cost of road maintenance to a figure far beyond anything anticipated when the laws which governed maintenance of roads were framed. Further, it may be affirmed that to try and alter, adjust and tinker up laws and regulations which were framed for an entirely different set of conditions, is hopeless and impossible. A fixed principle and a comprehensive and equitable system applicable to all, must be evolved and adopted.

Not only is the damage to the surface of the old roads apparent but it is obvious that the method of construction is quite inadequate to carry the traffic of to-day, and it will have to be replaced by an infinitely more costly construction if they are to last for any length of time. The question arises therefore as to who should bear the enhanced cost of providing and maintaining this specially constructed type of road or track.

Let us examine the case of the tramways. About 1870 the necessity for providing some kind of vehicle which would carry a large number of people quickly and cheaply from the outskirts to the centre of cities and large towns was felt. It was impossible for the roads existing at that time to stand the wear and tear of such a vehicle, and it was decided to follow railway practice as far as possible and to put rails in the streets upon which these vehicles could run.

Immediately legislation was framed, which imposed on tramways the necessity of maintaining not only their rails but the paving between the lines and 18 inches on either side of them. This undoubtedly established the principle "that the user should pay for the construction and maintenance of any special form of track on the highway," and, so far as I am aware, no complaint was received from the tramway undertakings, as it was obvious that with horses running between the rails the actual damage done to the roads was not confined to the presence of the rails alone but also to the extraordinary wear and tear of the road surface between them.

When horses were discarded and the electric motor took their place, the imposition of repairing the paving as well as maintaining the rails still remained. It was borne without any serious grumbling on the part of the tramways for some considerable time, due to the fact that as they held a monopoly money came in easily, running expenses were low, and the burden was not felt. In other words, "the goose that laid the golden eggs" did not miss one or two.

The position to-day is entirely changed. The goose has ceased to lay, and not only ceased to lay but in many cases, with unfair competition, and the enormous increase in running costs is well nigh cooked, and there is no room for philanthropy.

Problem of the Allocation of Costs.

The weight of the old horse cars was somewhere in the neighbourhood of two tons each unloaded and a special track was required to carry them. To-day, we have motor vehicles weighing five tons unladen and twelve tons laden running without rails, and a special form of track must be provided for their accommodation. Because that special form of track happens to embrace the whole of the road surface, it does not make it any the less a specialised construction, nor, in my opinion, does it make it any more equitable that the people for whom this track is provided should escape their fair share of the cost of such track.

Tramways to-day are asked to pay not only for the upkeep of their permanent way, including the road surface with a margin of 18 inches each side, but it is required that this road surface shall be of a specialised and expensive construction for the use of their competitors and others. In addition to those charges they have to pay rates for the maintenance of this same expensive class of road construction for the use of all and sundry, in addition to the portion of the road which they share with others and have to maintain in its entirety.

There is no equity nor can there be any defence for such a state of affairs. I agree that the actual allocation of costs may be a little complicated, but it certainly is not an impossible problem. That one form of traction should be so penalised while another form of traction is so subsidised is not only inequitable and unfair but truly uneconomical.

It has been stated that the road charges per ton mile of motor borne goods under existing taxation is approximately ¼d., whereas the true cost is well over 1d. The difference must obviously be found by the ratepayer, whether he be landowner, tramways or railways proprietor, and it has been argued that the advantages gained by the community warrant the imposition of this charge. If communal principles are to be applied to one form of traction, then let them apply to all. It is fatal to good government to mix the principles on which that government is founded. I appreciate the attitude of the champions of the commercial motor vehicle whose sermon is based on the charge "Bear ye one another's burdens," and their determination that others shall not suffer for want of precept or burdens is to be commended.

Let us by all means have the cheapest form of traction and let the infallible rule of the survival of the fittest obtain, but to load one form of traction with the burdens of a competing form of traction is neither common sense nor true economy, and the ultimate result is bound to be an increased cost of transport. To say that the ratepayer and landowner is benefitted to the extent that he is taxed on this account is stretching the imagination.

If a landowner receives benefit in the form of appreciated land values by the conversion of his land from agricultural to building land, his assessment and taxation immediately take their toll of his increased values. If the ordinary ratepayer gets a little advantage in the actual cost of an article because transport is

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cheap but has to pay five or six times the amount of that advantage in the form of taxes, for the conveyance of goods which do not interest or affect him, he obviously is not a gainer by the transaction.

There are optimists who tell us that things will soon be better, and that when all the roads are reconstructed the cost of maintenance will be less. When? In the meantime, attempts are being made to meet what everyone is agreed should be a capital expenditure (i.e., the cost of the initial reconstruction) out of revenue, with the result that large sums of money are wasted in trying to compromise between the cost of a really sound job and the breaking point of the long suffering ratepayer.

SUGGESTIONS FOR A SOLUTION.

The problem must be dealt with as a whole, and settled on sound business lines, and I offer the following suggestions as a basis of settlement.

1—Transport requiring specialised track should pay for the additional cost of such track.

2—The burden of such cost, whether in the form of rating, taxation, or individual maintenance, should be equitably distributed between various classes of transport.

3—The initial cost of reconstruction should be capitalised, with repayment on conservative lines.

4—The contour of the roads should be dealt with in addition to their construction, and as far as possible sharp bends removed with their high maintenance costs, and full advantage taken of the special powers in existence for dealing with the land affected.

Dealing with No. 1, it should be an easy matter to get from actual data the amount of wear and tear done to the roads by each class of vehicle. I suggest that the contribution from rates for road maintenance should be equivalent to the cost of road maintenance in the district before the serious advent of motor vehicles with fair additions for the increased cost of the same type of road in labour and material.

No. 2. It is obvious that in dealing with the question of payment, the rating, taxation and any specially imposed conditions as to maintenance of track must be considered collectively if a fair division is to be arrived at. Compare for instance—

Tramways.—Rated on the whole undertaking plus maintenance of track with margins, plus small tax 15s.

The Commercial Vehicles.—Rated only on depot with maximum tax of £30 per annum per vehicle.

No. 3. This is so obviously the proper and most economical procedure that comment is superfluous. I suggest that the fund should be administered by a central body in consultation with district committees and the work done by contract with competitive tenders. the annual charges being properly allocated to the districts concerned.

No. 4. The cost of road maintenance does not entirely depend on road construction, but is affected to a great extent by the contour of the road. In other words, the straighter a road, the cheaper the maintenance. In certain districts where the original road makers attempted to go round each boundary fence, the cost of maintenance is out of all proportion to the mileage maintained. If the costs are to be kept down then these roads must be straightened. Corners and curves which were possible for country carts are out of the question for motor traffic with an average speed of 20 miles per hour.

It is imperative that the matter shall be dealt with thoroughly and at once; delay means vastly increased expense. The position to-day is that the first-class roads in many cases are so bad that the motorist is using second and even third class roads in preference, which means that shortly all roads will be bad, only some will be worse than others.

If the first-class roads are tackled promptly and well, there is some hope of saving the second and third-class roads.

PROFITABLE CAR MILEAGE.

HOW THE OPERATING STAFF CAN IMPROVE THE SERVICE.

By EDMUND ALMOND.

(*Traffic Superintendent, Tynemouth and District Electric Traction Company, Limited*).

During the past few months I have read with some concern of the unfavourable financial position of quite a number of tramway undertakings in this country. Some of those responsible too often take false comfort by simply referring to some other undertaking which is also adversely situated. I have no doubt that in certain cases the position would be improved if a careful survey were taken, and all things that matter thoroughly overhauled so as to combat and successfully overcome the various difficulties which at present arise. In the following short article I have endeavoured to touch upon the subject without unduly labouring any of the items mentioned.

The permanent way must, of course, receive careful and economical attention; penny wise and pound foolish policy ought to be avoided. All reasonable repairs and renewals should be carried out expeditiously and soundly, as smooth track is naturally a great asset in achieving success.

Much inconvenience, delay and annoyance to the travelling public is caused by ill-kept overhead equipment. Stoppages due to a faulty or worn-out line, or damaged and frequently disabled trolleys, are an advertisement of the worst type. The overhead system, section pillars and cables ought therefore to receive thorough attention and regular inspection.

A special endeavour should be made to ensure that all cars are well equipped and maintained; truck wearing surfaces should be watched and lubricated. The utmost care should be taken to eliminate avoidable noises, particularly those arising from the meshing of gears and ill-fitting gear cases.

Cleanliness should be a special feature. Dust and dirt should be removed from painted and varnished woodwork, fittings and windows, etc. Light soap washing ought to be carried out periodically, and disinfecting regularly practised. A sufficient number of straps should be provided inside the cars to enable passengers to pass speedily up and down. Ventilators should be kept in good working condition; creaking and draughty doors may be avoided by having them fitted with suitable "anti-rattlers." Trap-doors should fit accurately, and the flooring boards should be well covered with level, even laths. Loose projecting screws and nails ought not to be neglected, as they are liable to bring about claims for injury to passengers. At night a nicely lit car, with neat shades on the lamp fittings, affords in itself a strong attraction.

Fare stages should be arranged as far as practicable to fit in with places of importance and centres which

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are most frequented. A neatly printed table of fares is desirable in the notice case of all cars.

Full and minute consideration should be given to every source of traffic. Approximate expenditure per car-mile ought always to be kept in mind. The necessary number of cars should be turned out to meet as far as possible all traffic requirements at different periods of the day. Running unnecessary excess mileage during slack periods of the day, and, on the other hand, failing fully to cope with the traffic in the busy periods by using an insufficient number of cars, should be avoided. An excessively loaded car soon becomes unmanageable. A clearly set out time table is required in all cars. Any alterations in, or additions to, the car service should be advertised by a conspicuous and timely notice. It is essential to keep in continual touch with the travelling public by letting them know what you are doing, and what you are prepared to do.

Instructional notices to passengers must be concise and pithy as possible. Some of these may be posted on the end panels, inside the dash-plates, and on the inside of the top decency boards. Others may be printed on strong adhesive transparent paper for use on the windows, notice-case, and doors. Such notices, if got up in attractive form, do not mar the appearance of the car.

Motormen should be taught that an important part of their duty is to give the travelling public a good impression by letting it be seen from their carriage and demeanour that they are fully skilled in their work. They should always appear cool and collected, and avoid showing excitement or temper. It is equally undesirable that they should be seen struggling with their car, as though its management was an arduous task. During busy periods they ought always to assist the conductor as much as possible. When traffic is normal they should make a point of giving way to any intending passenger who may make a reasonable attempt to reach a stopping-place. The man who studies and obliges his passengers does a great deal towards permanently increasing traffic.

The selection of suitable applicants for the position of conductor is a difficult problem. To say the least, they must be smart, intelligent, and also keen in the right direction, for their's is the task of making the money. The rear platform of a car is no quarter for drones. Conductors should practice being automatic in their movements. Their attitude towards the travelling public should be attentive, civil, tactful, and they should cheerfully grant all reasonable requests.

Inspectors must be more than mere ornaments. The manner in which they carry out their work ought to be exemplary. They should be skilled in the tactful correction of motormen in the manipulation of their cars, and also in dealing with conductors. On approaching a car an inspector ought at once to note whether it is on time or not; to see that the route indicators are correct; observe if there are any new marks or disfigurements about the car; smartly note the movements of the conductor; see that all fares are collected, and tickets correct; compare the conductor's ticket clip with the waybill, and see that the necessary particulars are entered up. Inspectors should avoid unnecessary gossip with both the running staff and the public. They should collect all useful information in connection with the working of the undertaking, and report this at the proper time and to the proper authority.

Each member of the running staff should adopt as his motto, "Civility with just the necessary measure of dignity." They should also remember that it is not only necessary to make themselves popular with the travelling public, but to strive also to make the undertaking popular.

SLEEPER TRACK TRAMWAYS.

Middlesex Council's Inspection of Birmingham and Liverpool Schemes.

A committee of members of the Middlesex County Council were appointed—as was briefly reported in a previous issue—to visit Birmingham and Liverpool to inspect the arterial roads in those cities along which high-speed tramways on sleeper track have been constructed. The committee report that they were interested to find that Birmingham has a very complete scheme for radial arterial roads from the centre of the city to the outer boundaries, and also a ring road to connect up these arterial roads, enabling traffic to pass round the congested portion of the town. These roads vary in width from 104 ft. to 110 and 120 ft. The last-named is the width found most satisfactory, as it gives a convenient space for separate carriageways and a centre tramway track. The committee gathered from the city engineer that the 104 ft. width road was somewhat narrow for the purpose; that 110 ft. was just sufficient, but 120 ft. was most desirable as affording ample width for the track, the duplicate roads, and a wide footway, which he considered desirable to accommodate mains and drains. Several lengths were seen under construction, and some were finished with grass-covered track complete, which appeared to be desirable and attractive.

In Liverpool the committee found a very complete system for arterial roads, planned on much the same general lines as at Birmingham, including radial arteries and a ring road. These are now in course of being laid out and constructed to the general width of 120 ft., and in some cases 150 ft. One road is 250 ft. wide. In this case the carriageways are wide apart, and the centre forms a kind of longitudinal park.

The general standard at Liverpool appears to be two 24 or 25 ft. carriageways with a 27 or 29 ft. centre space, bordered by privet or poplar hedges, with the tracks and margins laid down with grass. This gives the tracks a very clean, bright and pleasant appearance, which strongly impressed the deputation. The saving made in cost of construction of double-track tramway under this system represented an economy of approximately 50 per cent. on the usual street methods, and in effect this saving had been about equal to the cost of purchasing the additional land to provide 120 ft. widths instead of the bye-law width of 60 ft. It was noticeable that the tramways were almost noiseless. The wear and tear on the track, the committee think, could only be slight, and the speeds obtainable were much higher than would be safe on the ordinary highway. The deputation were satisfied that there was no difficulty in regard to the crossing places of other highways, as they could be quite conveniently arranged.

Generally the committee were much impressed with the success of the schemes, and are of opinion that it is the right system to adopt for such thoroughfares as the Uxbridge Road. They have recommended that negotiations be commenced with the London United Tramway Company to endeavour to arrange fair terms for the construction of such a track on this road.

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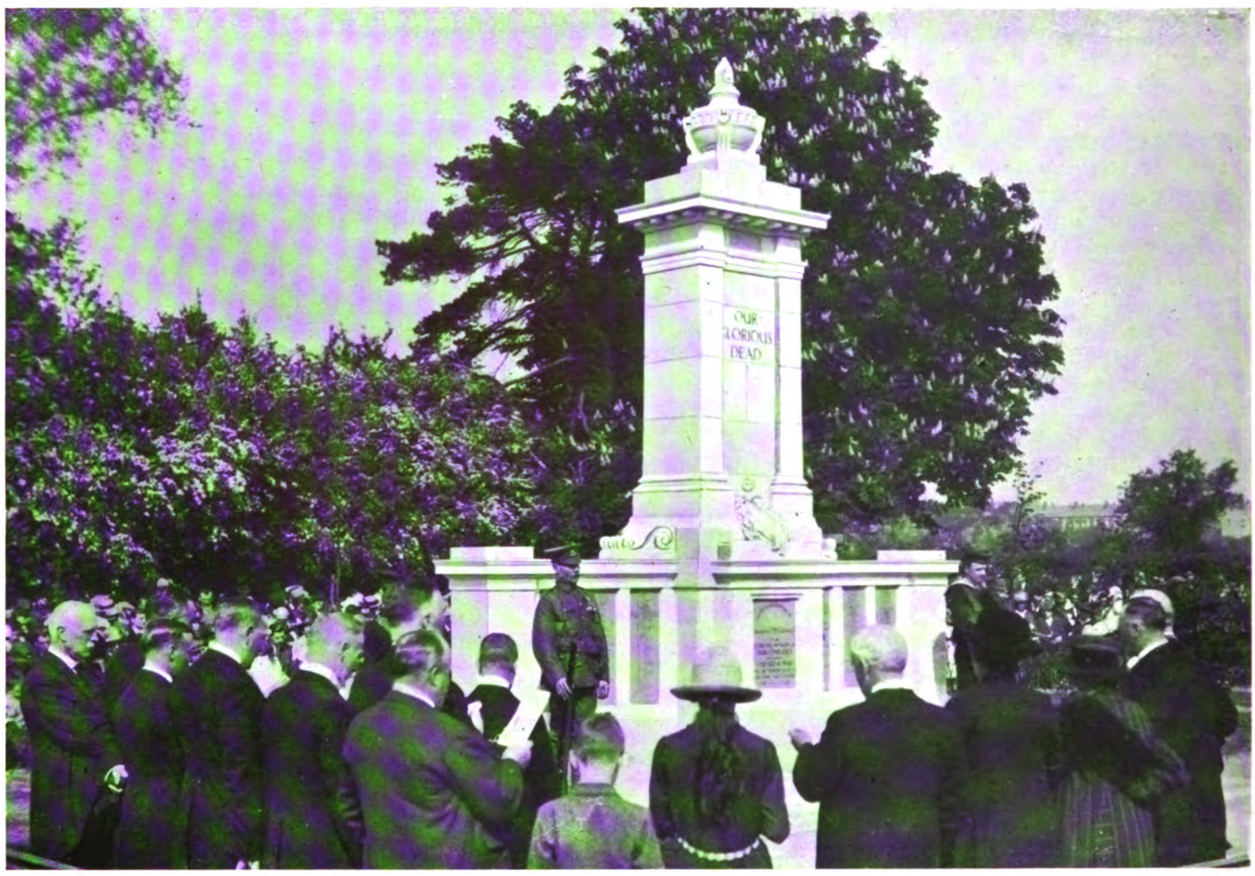
BIRMINGHAM TRAMWAYS WAR MEMORIAL.

EMPLOYEES' TRIBUTE TO FALLEN COMRADES

To perpetuate the memory of 236 employees of Birmingham Corporation tramways who fell in the war, the imposing memorial illustrated in the accompanying photographs has been erected at the Tramways Stadium, King's Heath. The monument was dedicated on Sunday, May 28, by the Bishop of Birmingham and the ceremony was attended by some 2,000 tramways employees, their wives and families, who were conveyed to the Stadium in special cars. Among others present were the Lord Mayor (Alderman David Davis), the Town Clerk (Mr. F. H. C. Wiltshire), the Chairman (Mr. F. Smith) and members of the Tramways Committee, the general manager (Mr. Alfred Baker) and the principal officers of the department.



The Dedication of the Birmingham Tramways War Memorial.

The monument, which is enclosed in a formal garden fenced off from the playing field by a beech hedge, is approached from the gateway by a stone flagged path which also surrounds the monument. It has always been the earnest desire of the men to mark in this way their reverence for the memory of their fallen comrades, and the "Garden of Rest" forms an appropriate setting for the memorial. It will be laid out with grass lawns beautified by flower beds and standard roses. The cenotaph is built, as already mentioned, in Portland stone, except the tablets containing the names of the fallen which are in Hopton Wood stone. There are nearly 300 names, arranged under the different depots to which the men were attached in alphabetical order, and the design allows them all to be exhibited and easily read from the front of the memorial. The central portion is surmounted by an urn and is reserved for the inscription: "Our Glorious Dead." Laid on the lower ledge is a carved wreath of victory, above which is the badge of the Tramways Sports Club. On the chief panel of the pedestal is inscribed the purpose of the memorial and a representation of the City Arms. The height of the central pylon is 20 feet and the length, including the two wings containing the panels of names is 17 feet.

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The work has been carried out by Messrs. J. Bowen and Sons, contractors, from the design of Messrs. Harrison and Cox, architects. The garden work is by Mr. J. D. Jones of Bournville.

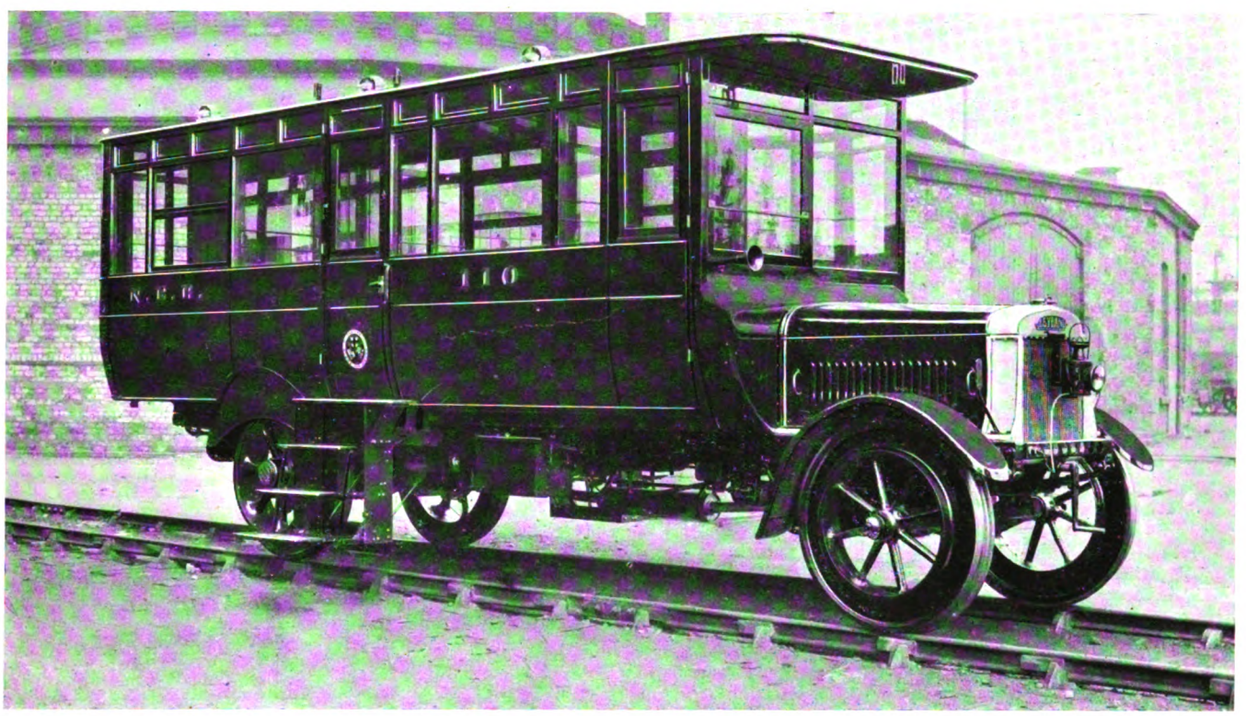
Mr. Baker, the general manager of the Corporation Tramways, speaking prior to the unveiling, said that on the outbreak of war no body of men answered the call with greater enthusiasm than the Birmingham tramwaymen. In less than a month upwards of 600 men, or 20 per cent of the number employed by the department, had either rejoined their old colours or had gone into training. Throughout the course of the war, the tramways department supplied to H.M. Forces no fewer than 1,800 men, a large number of whom gained honours and distinctions, while no less than 236 men laid down their lives. The whole cost of the memorial had been contributed by the present tramway employees themselves, without any assistance from the Tramways Committee or the Corporation.

A PETROL RAIL MOTOR OMNIBUS ON THE NORTH EASTERN RAILWAY.

For some time past the North Eastern Railway Company have realised that on certain portions of their railway there was room for a service conducted on lines as nearly as possible identical with those of motor omnibuses on the roads. With the view of ascertaining, without much initial expenditure, whether the scheme is likely to prove financially successful, they have converted one of their Leyland road motor omnibuses, ormerly running on the road services in the vicinity of Durham, so as to make it suitable for running on the railway. By the courtesy of Mr. R. L. Wedgwood, general manager, North Eastern Railway, we are able to reproduce a photograph of the rail motor omnibus.

The enormous increase in railway working expenses, due to various causes arising out of war conditions, has made it impossible to provide on some of the country branches, where the number of people travelling is small, a train unit sufficiently cheap to cover its working expenses out of the small revenue available, and it has become necessary to devise a cheaper train unit than the ordinary one with a steam engine and one or more ordinary railway carriages. It has been felt that by adopting the petrol engine, a train unit sufficiently cheap to meet the existing conditions can be devised, and the petrol rail motor omnibus which the North Eastern Railway Company put into traffic on Wednesday, July 19, is a first step in the investigation of this problem. The vehicle in question is not considered by the Company's officers as anything like the last word, and it is only possible to make experiments on a very small scale. If, however, the results of the working of this vehicle are encouraging, the company intend to build vehicles of a special design, carrying up to 40 passengers, and maintaining an average speed of approximately 30 miles per hour.

The present omnibus is running between Copmanthorpe, York, Strensall, and Earswick, and is manned by a motorman and a conductor, exactly in the same way as if it were running on the highway. Single journey tickets are issued on board, so that passengers have not the trouble of going to the booking office. It has accommodation for 26 passengers. It can be driven from both ends, and run in either direction, and the motive power consists of a 35-H.P. Leyland engine of the standard type, supplied by The Leyland Motors, Limited, of Lancashire, for their ordinary commercial road vehicles.



Petrol Rail Motor Omnibus—North Eastern Railway.

The London General Omnibus Coach Department is placing on the road 20-seat coaches with pneumatic tyres. The company is not in favour of such tyres, as at present manufactured, for larger coaches. Experiments made show that to support a fully loaded vehicle of the latter type the tyres had to be inflated to a pressure of 125 lb. to the square inch, with the result that there was but little difference in resiliency as compared with deep section solid tyres. The maintenance cost of pneumatics, the department finds, is four times more costly than with solids, but that consideration would not count with the company if they could ensure that there would be no risk of accident in the event of deflation.

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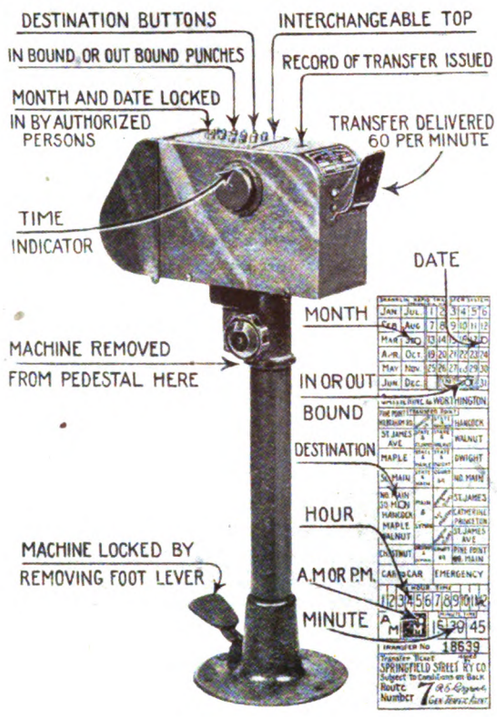
NEW TICKET-ISSUING MACHINE

IN USE ON LONDON UNITED TRAMWAYS.

An ingenious new ticket machine has been installed by the London United Tramways, Limited, on their one-man car. The machine not only punches on the ticket the date, time, direction, leaving stage, and



Transfer or Zone Ticket-Issuing Machine.

price paid, but also sums up in pence the prices punched. The operator hands over his cash in accordance with this register at the end of the day.

This automatically issues the ticket to the passenger. The date is locked in the rear of the machine, and is changed daily. The time is set with two small dials on the sides, which, together with the direction button, are changed at the end of each trip. The machine is small and compact—only weighing 21 pounds—and is mounted on a pedestal. There are two pedestals, one at each end of the car, an arrangement which enables the operator to change the machines at the conclusion of each journey.

In Operation on the London United Tramways One-Man Car.

The ticket is held by the passenger until leaving, and is then given to the motorman, so that he can check up to see that the passenger has not over-ridden. This arrangement not only gives the operator an absolute check on all passengers, but is also useful in making up traffic charts and for statistical purposes. The machines are manufactured by the Shanklin

One-Man Tramway Car—London United Tramways, Ltd.

The machine is under the control of the motorman, and as each fare is paid he simply sets two buttons at the price paid and the stage number to which the passenger is entitled to ride, and operates a foot pedal.

Equipment Company, of Springfield, Mass., U.S.A., and the installation has been made by Mr. Arthur L. Chase, a representative of that company who came to London for that purpose.

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THE LIFTING OF TRAMWAY STANDARDS

USE OF HYDRAULIC JACKS AT LIVERPOOL.

Managers of tramway undertakings were recently invited in these columns to send to us particulars of any methods they had resorted to for the purpose of reducing working and maintenance costs, other than reductions of wages agreed upon by the Joint Industrial Council. By the spreading of a knowledge of any such innovations benefit will accrue to the tramway industry, and the publication will serve in a measure to hasten the day when the public can be given reduced fares.

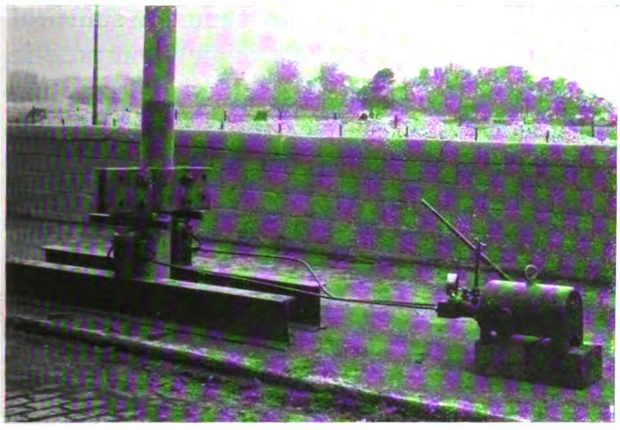


Fig. 1.

On this page are reproductions of two photographs which serve as speaking witnesses of a departure which has effected considerable economy. For these illustrations we are indebted to Mr. P. Priestly, A.M.I.E.E., M.Inst.A.E., the general manager of the Liverpool Corporation Tramways. Mr. Priestly has adapted the hydraulic jack to the task of lifting tramway standards out of the ground. Hitherto this operation has been a very cumbersome one, involving hand labour and sometimes the use of a crane for lifting the pole when it has been freed from its bed. The new method should be particularly useful on undertakings where standards are being removed from the centre of a track in favour of other methods of suspending the overhead equipment.

With the aid of hydraulic jacks, standards at Liverpool have been lifted which had been in position for periods of between fifteen and twenty years. The poles have come straight out of the concrete without any digging whatever. The economical aspect of the use of jacks will be appreciated when it is stated that at least three standards can be lifted in the same time that it previously took to lift one. Further, it is only necessary to employ two men instead of four. Fig. 1 shows the lever-controlled machine which by hydraulic pressure operates the two jacks. Fig. 2 gives a clear indication of the jacks forcing the standard out of its bed.

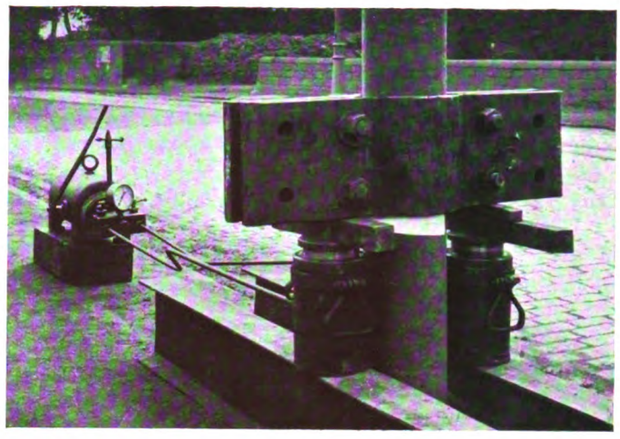
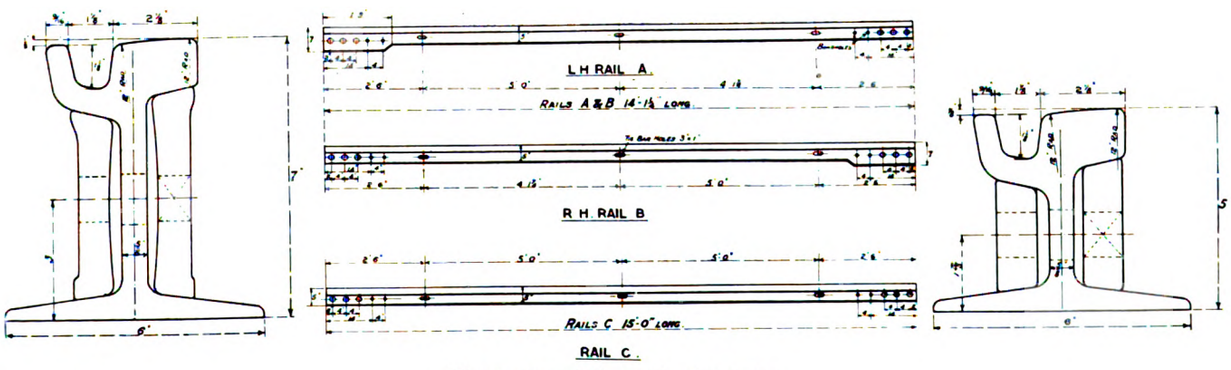


Fig. 2.

MANGANESE RAILS AT SOUTHAMPTON.

In our June issue some illustrations and particulars were given of a special manganese track through the historical Bargate at Southampton. We are now enabled to give some further details and a section of the rail, etc., which have been kindly supplied by the makers, Messrs. Edgar Allen and Company, Limited, Sheffield.

Owing to the low height of the Bargate, and the fact that every inch of head room was valuable, a shallow section of rail 5 in. deep was decided upon, and this was laid for a length of 194 ft., the rails at the extreme ends of the track being cast 7 in. deep, so as to connect with the ordinary tramway rails, and the illustration shows both sections of rails with details of the lengths of the cast rails.



Manganese Rails at Southampton.

The track was put together at the makers' works before being sent and was ready for laying down without delay when the ground was opened.

The New L. & N.W. Electric Service.—On Monday, July 10, the suburban stations of the London and North Western Railway at Kilburn, South Hampstead, and Chalk Farm were reopened for passenger traffic, and on the same day the electric line from Watford to Queen's Park was opened to Euston.

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THE EDITOR will be glad to consider articles by experts. All information of a practical character relating particularly to the engineering and operating branches of transportation will receive prompt attention Original illustrations will also be welcome.

LONDON, AUGUST 24, 1922.

Electricity Supply. After a prolonged struggle the Electricity (Supply) Bill was passed by Parliament shortly before the close of the session. Weeks before it had been the subject of various discussions in the House of Lords, and a number of changes were made in it. Later the same process was repeated in the House of Commons, and ultimately it was read a third time in the latter House on July 25. In spite of all the discussion and all the changes the main objects of the Bill have been secured. It may be recalled that in 1919 the Government introduced in the House of Commons an Electricity Supply Bill which aimed at giving the country a comprehensive and cheap supply of electric energy for all purposes. The compulsory powers contained in that Bill were strenuously opposed, especially when it got to the House of Lords, and then the Government dropped the compulsion element, and made the whole scheme a voluntary one, promising to submit an amending Bill afterwards to remedy defects. The Bill of 1919 in the form in which it became an Act constituted the Electricity Commissioners with wide powers exercisable by agreement, including authority to divide the country into electricity districts, to frame schemes for electrical development for these districts, and to constitute joint electricity authorities for carrying on the work in the districts. Progress has been hampered, because in the Act as passed the joint electricity authorities were given no financial powers. The full working of the Act has remained in abeyance pending the passing of an amending Bill. The Government failed to pass the promised Bill in 1920 and 1921, but after some wavering they managed to summon sufficient decision to carry out their original purpose in the session now closed. The new measure has been somewhat whittled down, but it will serve a useful purpose, and enable the Electricity Commissioners to carry on their work more effectively. Opposition came from those who feared additional burdens on the ratepayers, from those who scented more bureaucratic control, and to a certain extent from some advocates of private enterprise and unrestricted freedom in the matter of electrical supply. The main object of the Bill may be said to enable the joint electricity authorities to borrow money under certain conditions and limitations for the payment of the purchase price of generating stations and main transmission lines and for the carrying out of works. The authorities can issue stock for the discharge of purchase price, and authorised undertakers, local authorities and others may give financial assistance. The rest of the Bill is a mass of detail, consisting in part of ancillary or subsidiary powers and in part of limitations and conditions as to the exercise of powers. Such exercise is indeed so hemmed in that it may be doubted whether in practice the Bill will be as efficient an instrument for development as it might have been made. Of course various conflicting interests had to be conciliated, and the methods by which this was accomplished hardly add to the prestige of the House of Commons. The practice of settling details of public Bills by private negotiation outside the House is not one that should be encouraged. It will inevitably be some time before a definite judgment can be formed as to the working of the scheme. So far as electric traction interests are concerned the hope is that by co-ordination and, where advisable, consolidation a supply of electric energy may be obtained at low cost.

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The benefit should accrue mostly to undertakings which are now supplied from small stations, as it can hardly be hoped that the cost of production can be brought much lower than it is at present in the great generating stations of the country. A very valuable feature will be the bringing of a public supply of electricity for power and light into areas which could hardly even hope to provide it for themselves. One result should be the establishment of smokeless factories in rural districts where land is cheap, and a consequent spreading out of the population.

Emerging from Trying Times.

In almost as great a degree as the tramway car the omnibus has experienced disadvantages from the economic conditions of the past two years. Managers of undertakings operating the two classes of vehicle have on the whole had the satisfaction of finding them both emerging into somewhat less troubled waters as the result of the past year's working. One aspect of the year ended on March 31 last will always redound to the credit of the omnibus, namely, the manner in which that vehicle and the motor coach enabled passenger services to be continued to a great extent when tramway transport suffered curtailment on account of the coal mine trouble. The year was also noticeable on account of the introduction of numerous new omnibus services, the vehicles being purchased at a period when high costs threatened to make both new and reconstructed tramways prohibitive. The omnibus has proved its utility as a maid-of-all-work, and there is no need to plead extenuating circumstances for the financial discouragement so widely experienced two years ago. Still it may be useful to point out two outstanding facts. One is that on most of its routes the omnibus, on account of its mobility, has to create traffic. It is not plumped down into a heavy demand for its services as is often the case with the rail car. Another noteworthy feature is that municipal operation has to meet capital obligations that are not imperative with private enterprise. There are also two items in which the economic outlook of the omnibus has greatly improved. A lowering of prices by the makers is a healthy sign; a fall in the charge for petrol is another encouragement. In the latter direction further economies are not unlikely during the present year. How important fuel costs are is shown, for instance, by the accounts of Warrington omnibus department, the cost of petrol for 1921-22 having fallen to 5·749d. per mile from 8·142d. in the preceding year. Other undertakings which have experienced a successful year include Birmingham, Manchester, Wolverhampton, and Eastbourne. In the present year's working a new source of interest will be apparent in a number of municipalities. We refer to the trial which is being given to the one-man operated omnibuses, generally of the railless type, for from sixteen to twenty passengers. These vehicles have already proved their advantages in several localities, and there is little doubt that their number will soon be much increased. In fact the railless system, as was remarked in these columns when it was unknown in this country should more than ever before be closely studied by tramway authorities, who are responsible for providing much needed additional facilities for local transport.

Weak in Law and Logic.

The Manchester County Court judge ought to feel convinced by this time that he is mistaken in his assertion that other traffic is under no obligation to give passage to a tramway car. The judge's dictum was discussed from several aspects in our issue of July 15, but there are one or two further points that should be emphasised. A county court judge should be aware that no vehicle is entitled to obstruct the passage of another one longer than is warranted by the position of the traffic ahead of it. Prosecutions on this count are not confined to the obstruction of tramway cars by other conveyances. It is common to find cases in which motor lorry and tractor drivers are prosecuted for obstructing the ordinary motor car for long distances. The tramway car is specially provided for under the Tramways Act, under which wilful obstruction is punishable with a penalty not exceeding five pounds. In some towns the authorities have yet another method of procedure in the form of a local by-law which compels slow-moving traffic to keep to the left. The London County Council and Glasgow Corporation are

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amongst the possessors of this regulation. Notwithstanding that this is a procedure which motorists have long advocated in order to lessen the obstruction to fast traffic, this by-law is not in favour either with the Ministry of Transport or with the London police authority. Efforts were made a year or two ago by another tramway authority in the Metropolitan area to secure a similar by-law, but it was discountenanced by the official bodies already alluded to. Apparently their view was that wilful obstruction can be dealt with by the ordinary statute. That decision, however, has not prevented the Plymouth Watch Committee from issuing a regulation that slow-moving vehicles except when overtaking another must keep as close as possible to the kerb. Regarded from the point of view of logic, Judge Mellor's assertion is at least extremely unfortunate. It is an encouragement for every driver to become a law unto himself, in which event we might witness a revival of the "six-shooter" days of the backwoods of America.

TRAMWAY EMPLOYEES' WAGES.

AGREEMENT TO TERMINATE ON SEPTEMBER 21.

Negotiations between tramway employers and employees in regard to the proposed reduction in wages are proceeding, and it is hoped that a satisfactory arrangement may be arrived at without serious difficulty. There is, however, considerable dissatisfaction among employees throughout the country at the intention of the employers to terminate the sliding scale agreement, in accordance with the notice which was given on June 21, 1922. By this notice, which the Minister of Labour has decided is valid and in accordance with the required conditions, the agreement arrived at on June 16, 1921 (published in full in our issue of July 14 last year), will be terminated on September 21 next. The leaders of the men seem to be somewhat less than candid in their statements in regard to the position, and the employees are being led to believe that the employers are violating an agreement. This, of course, is not the case, as the agreement provides for the termination of the present arrangement by three months' notice on either side. It was never intended that the agreement should be permanent, and it would, indeed, have been impossible in 1921 to make any permanent arrangements in regard to wages, as the economic conditions were bound to alter greatly.

The Joint Industrial Council for the tramway industry is to meet at the Ministry of Labour on August 25 to consider the position which will arise when the existing sliding scale for the adjustment of wages expires on September 21. It is understood that both sides will make proposals, and it is hoped, although without much confidence, that a mutual agreement will be reached at the meeting. If not, efforts will be made to arrange a further conference.

TRANSPORT CONGRESS AT BRUSSELS.

FIRST MEETING SINCE THE WAR OF THE INTERNATIONAL TRAMWAY, LIGHT RAILWAY AND PUBLIC AUTOMOBILE UNION.

The eighteenth congress of the "Union Internationale de Tramways, de Chemins de Fer d'Intérêt Local et de Transports Publics Automobiles," is to be held in Brussels from October 2 to 9, 1922, under the patronage of the Belgian Government.

Reports will be presented on the following subjects—

1st Question.—Study of the Increase in Expenses since the War in Tramways and Light Railways and Public Motor Transport. The Capital Cost and Working Costs.

Reporter.—M. A. MARIAGE, President of the Administrative Council, Delegate of the Company of Public Transport in the Parisian District, Member of the Executive Committee of the International Union of Tramways.

2nd Question.—Automatic Sub-stations.

Reporter.—M. L. SEKUTOWICZ, Director of Technical Services of the "Omnium Lyonnais" at Paris.

3rd Question.—Processes of Electric Welding, or other Similar Methods, and their Application to the Installation of Tramway Tracks and Repair Shops.

Reporter.—M. E. D'HOOP, Manager of the Brussels Tramway Company.

4th Question.—The Economic Situation of the Swiss Railways from 1913 to 1920.

Reporter.—M. CH. ROCHAT, Managing Director of the Geneva Electric Tramways Company, Member of the Executive Council of the International Tramways Union.

5th Question.—The Mercury Vapour Arc Rectifiers in Tramway Systems.

Reporter.—M. ODERMATT, Engineer of Brown, Boveri and Company, Baden.

6th Question.—Operation of Light Railways by Rail Motor Cars.

Reporter.—M. J. DE CROES, Chief Engineer and Director, Société Nationale de Chemins de fer Vicinaux, Brussels.

7th Question.—Study of Various Kinds of Current Applicable in the Electrification of Light Railways.

Reporter.—M. A. PIRARD, Managing Director, General Works Company of Liége.

8th Question.—Motor Omnibus Service Organisation in Great Cities.

Reporter.—H. E. BLAIN, Assistant Managing Director of the London Underground Railways and the London General Omnibus Company Group.

9th Question.—One-Man Cars.

Reporter.—M. P.-N. NIEUWENHUIS, Manager of Arnhem Municipal Tramways.

10th Question.—Latest Improvements in Tramway Rolling Stock.

Reporter.—C. J. SPENCER, General Manager, London Group of Tramway Companies.

THE PROGRAMME.

The following is an outline of the programme of the Congress which will meet at the Palais des Academies, rue Ducale—

TUESDAY, OCTOBER 3.

9.30 a.m.	Opening of the Congress.
Afternoon.	Visits to the Colonial Museum and Tervueren Park, to which the members will be conveyed in special tramcars.
8 p.m.	Special performance at the Theatre Royal de la Monnaie, arranged in honour of the Congress.

WEDNESDAY, OCTOBER 4.

9.30 a.m.	Second session of the Congress.
Afternoon.	Excursion by special train to Charleroi, where members will be entertained at luncheon by the Ateliers de Construction Electriques de Charleroi. Visit to the works of the company.
6 p.m.	Return to Brussels by special train.
10 p.m.	Reception by the Brussels Tramway Company.

THURSDAY, OCTOBER 5.

9.30 a.m.	Third session of the Congress.
2.30 p.m.	Fourth session of the Congress.
5 p.m.	Tea at Brussels City Hall at the invitation of the Council.
8 p.m.	Banquet.

FRIDAY, OCTOBER 6.

9 a.m.	General Statutory Meeting of the Union.
Mid-day.	Departure by special train for Ghent, where the members will be entertained at luncheon by the Société d'Electricité et de Mécanique (Procédés Thomson-Houston et Carels). Visit to the Carels workshops.
6 p.m.	Return to Brussels by special train.

SATURDAY, OCTOBER 7.

Visit to the Front (special train to Ypres), luncheon at Ypres, visit to the battlefields by motor car, supper at Ostend.

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JUBILEE OF GLASGOW TRAMWAYS.

REMARKABLE PROGRESS OF A GREAT UNDERTAKING.

The jubilee of the Glasgow tramways, which were inaugurated on August 19, 1872, was celebrated in the city on August 18. For twenty-three years the service was provided by a private company, who leased the track from the Corporation, but in 1894 the undertaking was municipalised. Four years later electric traction was introduced, and in 1900 the horse car system was completely superseded. Under municipal management the service was rapidly extended. To-day the range of the system is over 100 miles of double track, and acquisitions and developments which are being carried out at the present time will add almost a further fifty miles. The efficiency with which the undertaking has been operated has earned for it a world-wide prestige, and reference is often made to it as a model of municipal tramway enterprise. The jubilee celebrations included the distribution of £1 each to all the employees in the service of the department, the reproduction of the opening ceremony of fifty years ago with a parade of a horse-drawn car of primitive type, and the holding of a civic luncheon and an evening reception in the City Chambers.

The Lord Provost of the City (Mr. Thomas Paxton) presided at the luncheon, and the guests included representatives of various tramway undertakings throughout the country. The occasion brought together an interesting group of managers of transport enterprises who were at one time or another associated with the direction of the Glasgow service. These included Mr. J. Barber Glenn, who was the first secretary of the Glasgow Tramway and Omnibus Company—the private concern which established the undertaking; Mr. John Young, under whose *regime* as general manager the service was municipalised, and who afterwards received an appointment in the administration of the London Underground Railways; Mr. J. B. Hamilton, who is now manager of the Leeds tramways; Mr. William Clark, at one time engineer to the Glasgow department, who was appointed manager of the Lisbon tramways; and Mr. M'Call, now general manager of the Shanghai tramways. Three of the group served under Mr. James Dalrymple, the present manager of the Glasgow tramways, who has been in charge since 1904.

PARLIAMENT AND MUNICIPALITIES.

After the loyal toasts had been submitted by the Lord Provost, **Sir Samuel Chisholm, Bart.,** proposed "The Houses of Parliament." He said that while Parliamentary control over local authorities was no doubt necessary in order to prevent chaos, there was a good deal to be said for greater freedom of action being allowed to such municipalities as that of Glasgow. Members of a city corporation had a closer and clearer vision of the needs of their own little kingdom and a firmer grasp of the best measures to adopt to meet the local requirements than could possibly be possessed by legislators who lived a large portion of their lives in London, detached by their circumstances from intimate sympathy with the local community. It would be absurd to ask that Parliament should grant everything that municipalities desired, but this much at least he thought should be recognised—that when municipalities, after careful consideration, brought proposals before the Houses of Parliament, these proposals should receive a favourable and friendly reception, and should not be dismissed simply because they were without any precedent. (Applause.)

Lord Belhaven and Stenton, in the course of his reply, said that the progress of the Glasgow tramways could be reviewed with genuine satisfaction. The success of the undertaking was undeniable, both in the matter of providing a cheap and excellent service for the community and as a remunerative enterprise that was now known far and wide and thoroughly deserved the great reputation it had acquired. Glasgow had been and still was a pioneer in the development of municipal tramways, and other Corporations were paying it the compliment still of copying its methods. The extension of the tramways had materially improved the social conditions of the city. It was a well-known circumstance that where the tramways came in slums receded and their places were taken by smart residential and business quarters. In paying a tribute to the wonderful efficiency of the service, Lord Belhaven declared that everyone who travelled by the Glasgow cars must be more or less impressed with the invariable good nature and courtesy displayed by the employees. A more obliging and civil body of public servants could not be met anywhere he believed in the world. (Applause.)

Mr. A. M'Callum Scott, M.P., and **Mr. F. A. Macquisten, M.P.,** also replied to the toast.

Alderman Clark (Rochdale) proposed "The Corporation of Glasgow," and in referring to the tramway system of the city he said the success of the tramways had done a great deal to add to the prestige of the city. The system carried with it great benefits to the citizens. He had been greatly impressed with the ceremony that day, and he thought no one could have witnessed it without being struck with the great difference there was in transport to-day compared with the earlier days of the system. Glasgow had been most fortunate in all the circumstances connected with their tramways, and particularly fortunate with regard to their tramway managers. (Applause.) The system would not have been what it was to-day had it not been placed under capable managership.

A RETROSPECT.

The Lord Provost, in response, said—I esteem it a great honour to preside on this historic occasion, marking as it does a notable milestone in the journey towards municipalisation of one of the most important and successful of the undertakings of the Corporation. The fifty years' history of the tramway undertaking furnishes an unexampled spectacle of continuous, prudent, and far-sighted management which I think has no parallel in any similar undertaking or in any country. Glasgow has been pointed to as a model for other cities in municipal activity, but in none has its claims to recognition as a pioneer found more ample justification than in the tramway undertaking. The inception and development of the undertaking for the last 50 years reads almost like a fairy tale. As someone said on the occasion of the celebration of the jubilee of our water supply in 1909, "We are paying tribute to-day to that which is the greatest of all qualities which go to the making of a State—the dynamic quality of imagination in civic life. Without it progress is impossible in any direction worthy to be desired. Without imagination the mind of the city, as of the individual, is fettered to stagnation and infertility." Those who have had the control of our tramways undertaking have in a pre-eminent degree shown that supreme quality of imagination as the history of the undertaking undoubtedly demonstrates. I need refer only very briefly to the successive stages of our tramways to prove the truth of that statement. It was on August 19, 1872—fifty years ago—that the first tramway was opened in Glasgow. The lines were leased to the Glasgow Tramway and Omnibus Company, and I am glad to learn that we have at our gathering to-day more than one of the gentlemen who were identified with it. The first route to be opened was from St. George's Road to Eglinton Toll—a distance of 2¼ miles—and by the end of 1872 four other lines were opened I would like at this point to pay a tribute to the manner in which the old tramway company discharged their duty for 23 years both to the Corporation and to the citizens, and it was through no fault of theirs, nor was it because of any lack of efficiency or administration that the Corporation in 1891 resolved to take over the control of the tramways into their own hands. The company's lease expired on June 30, 1894, and on the following day, over 28 years ago, the Corporation started to operate the tramways. Nobody but those who were in the Town Council at that date can realise the stupendous task which confronted the Corporation at this time. Owing to the negotiations for the acquisition of the plant and equipment of the old company falling through, the duty devolved upon the municipality to organise the whole service for themselves before the company's lease terminated on June 30. They had only about eighteen months to prepare, and in that short time so complete was the organisation in the able hands of the Corporation's first manager, Mr. John Young, whom I am delighted to see here with us to-day, that on July 1, 1894, a complete service of cars was placed on the streets, and the citizens were thus not inconvenienced by a single hour owing to the transference of control. The history of the tramways department ever since then has been one long record of success, and the fact that to-day the tramways undertaking stands pre-eminent among similar undertakings, and has shaped the municipal policy in connection with tramways not only in this country but throughout Europe, is due to the zeal,

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enterprise, and enthusiasm with which successive tramway committees and general managers have applied themselves to meeting not only the increasing travelling requirements of the citizens at the minimum charge, but to equipping and developing the system as a whole, and adapting it to the growing requirements of a growing population. The great strides which the department has made may be shown by quoting a few eloquent figures. In 1894, when the Corporation took over the tramways, there were only 32 miles of route. To-day there are 100 miles, and within recent weeks the Corporation, by the resolution to acquire the Airdrie and Coatbridge system and the Paisley tramway system, will add 21 miles, and if we include the subway, which was recently acquired, it will bring the total of mileage up to 146. Then with regard to passengers carried, it is almost unbelievable that while those numbered for the year 1893-94 fifty-four millions, they now number five hundred and nine millions. Revenue in 1894-95 stood at £226,414, compared with £2,354,294 for last year. It was no small thing from a financial point of view for the municipality to assume the control of such a gigantic undertaking, but it speaks volumes for the manner in which it was managed that in 1917—that is to say within 23 years

Glasgow Tramway Jubilee—Dense Crowds Watched the Parade of the Cars.

—the whole indebtedness of the undertaking was cleared off, and to-day the magnitude of the tramway undertaking might be summed up in the statement that during the last 28 years in which the municipality has provided the tramway facilities the grand aggregate of the passenger traffic has advanced to the colossal figure of over seven billions, while the revenue has approached twenty-seven million pounds, or an average of almost a million a year. I need say no more, but would conclude by congratulating all concerned, and it will not be invidious if I specially pay a tribute to the management, first of Mr. John Young, the original manager, and secondly to Mr. James Dalrymple, our present manager. The city of Glasgow has always been fortunate in its officials, but in none more than in those of the tramway department, and I consider it a very happy circumstance for me that this important celebration should take place during my term of office.

Councillor Mancor, convener of Edinburgh Tramways Committee of that city, proposed the toast of "The Tramways Committee of Glasgow." The efficiency of the Glasgow system, he said, was an incentive to all those who would learn by example. The Corporation of Edinburgh meant to emulate so far as it lay in their power the policy of the Glasgow Tramway Committee. When important guests were entertained in the city of Edinburgh they generally spoke of it as having a glorious history a fascinating past. But his view was that no city could live on its traditions alone, and it was clear to him that in the past Glasgow Corporation had never lent ear to such nonsense. From the press he understood that there was a certain section in Glasgow who thought the Tramways Committee should perform miracles financially—that they should immediately revert to the halfpenny fare. To the press who urged that he thought they might reply that the public would get back to the halfpenny fares the same day as they got back to the halfpenny papers. The governing factors were the same in both cases.

Bailie M'Whirr, convener of Glasgow Tramways Committee, in replying, said that the Tramways Committee had always been fortunate in having a splendid staff of workers. During the past two years the committee had had to consider some questions of very great and far-reaching importance. They had been called upon, for example, to decide as to the purchase of the Paisley tramways, the Airdrie and Coatbridge tramways, and of the Glasgow Subway Railway. Last year the committee had organised a great amount of relief work for the benefit of the unemployed, and only the other day they had agreed to a further scheme which would give employment to about 1,700 men for twelve months. After referring to the necessity for the withdrawal of the halfpenny fare in 1920, Bailie M'Whirr said he was sorry to say that a movement was now on foot to reinstate the fare on a slightly different basis. The proposal had been turned down at the meeting of the Tramways Committee by a small majority, and he hoped that when the question came before the Corporation they would support the majority of the Committee. The tramways had always been run on safe business lines, and they felt that it would endanger the financial position of the undertaking if they tampered with the fares at the present time. Dealing with the question of congestion of traffic, he said that the most effective remedy was unquestionably that of the construction of more bridges across the Clyde. The Corporation had already agreed that a bridge should be built at Oswald Street, but he was of opinion that another bridge was also required. With two bridges he believed that the traffic could be so spread as to remove the existing congestion.

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Sir W. F. Russell proposed "The Staff, Past and Present." The Glasgow Tramways, he said, since they had become the property of the Corporation, had been very fortunate in their managers, officers, and staff. In fact, the management and financial success had been the envy of all tramway undertakings not only in this country but abroad. No doubt the credit of all this was due to the efficiency and ability of the managers who from time to time had been at the head of the undertaking. They had with them that day the following past members of the staff—Mr. Barber Glenn, the first secretary of the tramway company in 1872; Mr. John Young, general manager; Mr. J. B. Hamilton, now of Leeds; Mr. William Clark, engineer, who was appointed to the Lisbon tramways, and had now retired; and Mr. M'Call, now general manager of the Shanghai Tramways. Mr. Young, after a successful period of management, had resigned to take up an important appointment in the underground railways in London. Mr. Hamilton had distinguished himself in many ways in Leeds as manager of the tramways there and other offices. As regards the present staff, following Mr. Young, Mr. Dalrymple was appointed general manager, and during his successful management the tramway mileage had been increased until it was practically 100 miles of double track. It was his privilege to have been a member of the Tramways Committee for twelve years, during which he was sub-convener for three years, and convener for three years under Mr. Dalrymple's management. During that period he had had ample opportunity of forming an opinion of the abilities of Mr. Dalrymple. The least he could say about him was that he could not name any Corporation or commercial undertaking that was more efficiently conducted and managed. (Applause.) Mr. Dalrymple seemed to have the knack of having under him officers of experience and training, in many cases trained under himself. Mr. Dalrymple was greatly assisted by Mr. M'Kinnon, assistant manager, and the general staff, including a head office staff of 322. There was a total staff of 8,746 men and women, and 62 per cent. of the total revenue was paid in wages. Last year 27 millions of miles were run, and 431 millions of passengers carried. That all this was accomplished with very few accidents reflected the greatest possible credit on the management and the whole staff. (Applause.)

Mr. Barber Glenn briefly expressed his thanks for the compliment paid to him.

Mr. John Young said—I ask you to accept my warmest thanks for the very kind and flattering terms in which Sir William Russell has proposed the toast of the staff, past and present, and for the generous way in which the distinguished company has received it. I am glad to be associated in the toast with the original secretary of the Glasgow Tramways and Omnibus Company, Mr. Barber Glenn, and heartily join in congratulating him on being in harness at 83, and as you can both see and hear, I am no longer young except in name. (Laughter.) It was in 1875, three years after the first tramways were opened, that I entered the Corporation service at 30, and for practically the next thirty years was one of the departmental chiefs. It is now eighteen years since I went to London, and it is wonderful how, even in that short time, one can feel so much a stranger. I suppose one could count on the fingers of one hand the present members of the Corporation who were members of the Corporation eighteen years ago, but I am pleased still to recognise many well-known and friendly faces.

It is a real pleasure to me—except for the speechmaking—to have the privilege of being once again present at a representative Glasgow gathering, more especially that the occasion is the celebration of the jubilee of the Glasgow tramways, with which my name happens to be closely identified. I can say in all sincerity that I have the pleasantest recollections of my thirty years' experience in Glasgow. From first to last I had the happiest relations with the ever-changing members of the Corporation and committees by reason of the goodwill and trust which always prevailed. As to the tramways, I am sure on this jubilee day you will excuse my saying frankly that I am naturally pleased to have had a fashioning hand in the creation and organisation and administration of the Glasgow Corporation Tramways Department, which in a very few years came to be referred to, the world over, as a record success in municipal enterprise. With regard to the municipal staff, past and present, I can truly say that the original staff—the selection of which was one of my responsibilities—was such that one could scarcely wish a better. And happily the present staff has so naturally evolved from the past, by a gradual succession within itself, as to remain practically the same thing continued. Many have been called away to occupy chief positions at home and abroad. They are represented here by Mr. Clark, Mr. Hamilton, Mr. McColl, and Mr. Goslin. But others have always been ready to step forward,

Glasgow Tramway Jubilee—Generations of Tramcars.

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and we have to-day Mr. Dalrymple as chief, Mr. McKinnon as second in command, Mr. Ferguson, Mr. Wilson, Mr. Braid, and others of the old days, worthily upholding the standard. This is surely as it ought to be. I wish godspeed to all who have been and are connected with the undertaking.

EARLY DAYS OF MUNICIPAL WORKING.

Perhaps, my Lord Provost, enough has already been said and heard for one day on the Glasgow tramways, but a jubilee is not an ordinary day, and on this historic occasion you may still be willing to hear shortly from me, even at the risk of repetition—I shall not trouble you with figures—a few episodes in the beginning and earlier years in the history of the tramways as a municipal undertaking. Carlyle says that "In any phenomenon the beginning always remains the most notable moment." You have heard that in 1891-92 the Corporation and the lessees failed in the negotiations for a renewal of the lease, and the Corporation thereafter, with public approval, resolved to exercise their already existing powers by taking the operation of their tramways into their own hands—the first Corporation to take that step, destined as it was to shape and influence municipal tramways policy everywhere. You also know that an offer was made to take over, at the end of the lease,

One of the "1872" Cars in the Jubilee Procession—Being Assisted to Keep on the Rails.

the entire tramways establishment of the lessees as it stood, at valuation as a going concern, and that the lessees declined it, declaring their intention of running opposition omnibuses. It was at this juncture that I was called in by the Tramways Committee to advise, and the whole position and policy were fully gone into. The outcome was that I became general manager of the new department, and with the necessary authority accepted, under the committee, the responsibility of planning, creating and organising an entirely new establishment, and of being ready to turn out the new municipal service on July 1, 1894—some eighteen months ahead.

About a dozen sites were purchased, on which were erected, to plans prepared in the departmental office, stables for 5,000 horses, car sheds for 500 cars, a large granary and forage store, and an extensive car repairing works and factory, with all appurtenances and machinery. The design of the new cars was likewise prepared and approved, and orders were placed for 400 to begin with. Within three or four months of the starting day about 4,000 horses were purchased, mostly from overseas. There were then the staff and whole personnel, some 4,000 in number, to engage and have in readiness for the appointed day. Obviously this was a very different proposition from simply taking over an undertaking as a going concern. But "all's well that ends well," and it proved to have been for the best.

The 1st July was a Sunday. Fortunately it was a day of perfect sunshine, quite a red letter day in the city. Punctually the new municipal service appeared all over the city, under improved working conditions and revised routes and fares, including the new halfpenny fare. The service was operated to schedule time and without a hitch. Success was secure from the very beginning. The competing omnibuses soon disappeared, and other Corporations who were interested onlookers hastened to follow Glasgow's example. So much for the first stage—the genesis of tramways municipalisation.

We were, of course, fully alive to the limits of horse traction. Mechanical traction was in the air, but the time for a public decision was not yet ripe. Overhead electric traction had already been introduced and was beginning to find favour abroad. Personally I was much taken with it. As a matter of fact, in 1893, we had the Maryhill and Springburn routes tentatively surveyed and estimated for, but, placed as we were, we found it impracticable to move in that direction at the start. For one thing no preparation for a change of traction could be made while the tracks were in the hands of the lessees. And we certainly gained by waiting. The cable system had for some time been in operation here and there abroad, but it did not make much progress. As far back as 1885, when in San Francisco on a short visit, I was shown over the cable system of that city, but I considered it cumbrous and inflexible. This, and many other systems, in being and embryo, were strongly advocated, and all were carefully examined on their merits.

ADOPTION OF ELECTRIC TRACTION.

Meantime electric traction was making steady progress abroad. On the first official tour of inspection on the Continent with the late Bailie Crawford, we saw it well installed and in full operation, and were so much pleased that we had no hesitation in recommending its adoption. The question being of so great public importance, the chairman and deputy chairman, Bailie Paton and Bailie Wallace, and several members of the committee, were deputed to make further investigations on the Continent, and I remember we had with us on that occasion your present highly esteemed member Bailie Burt. They were likewise favourably impressed with the system, and reported accordingly. Finally, so as to leave no doubt on the question, I was sent over with the chief engineering assistant, Mr. Clark, to America, to examine further and report. We found there that the overhead electric system was undoubtedly and speedily making headway, and we saw cable lines being pulled out to be replaced by it, so that we could do no other than confirm previous reports in its favour.

Thereafter, in 1897, its adoption was resolved upon by the committee and the Corporation, and as a demonstration it was first of all installed by our own staff on the Springburn route, in 1898. This proved so satisfactory that within a few months the Corporation passed a resolution to have the whole system similarly converted, and expressed the hope that the electric cars would be in operation at the opening of the International Exhibition at Kelvingrove in May 1901. The change involved a great upheaval. It meant the taking up and relaying with heavier 60 feet rails of practically the whole track, with the horse cars running all the time; the laying down of ducts all along the routes for the distributing cables; the setting up of a vast electric system, including a large power-station and sub-stations, and the electrical equipment of all the lines, rolling stock and depots; and the building and equipping of the larger cars in our own factories for which we afterwards designed the unobtrusive top covers.

In view of this second application of the time limit, plans and specifications were promptly prepared, and again operations were simultaneously pushed forward at all points—much of it with our own staff—and on the site purchased on the Canal at Pinkston the power-station was brought into being fully equipped to the plans of Dr. Parshall. The only hitch in the whole operations occurred through the brickwork contractors throwing up their Pinkston contract when they had little more than the foundations laid. The only way out of the *impasse* in time was for us to secure the materials and employ direct labour to carry on and complete the buildings. This was done. The result of it all was that on the opening day of the exhibition the electric cars were in operation according to plan. They got a most hearty reception, and again I was truly thankful. The success which followed, as is well known, was unprecedented. Fares, always the lowest on record, were further reduced. The service was speedily increased and extended, and the revenue kept mounting by leaps and bounds. Electricity had opened a new era with boundless possibilities for the future of the tramways. Glasgow's example in this second pioneering departure was again closely followed by other Corporations, and very soon the system was practically universal. This was the second stage—the exodus from the bondage and limitations of horse traction.

STRONG BUSINESS POSITION OF THE TRAMWAYS.

And now a few words on finance. With financial success assured at the beginning of 1894, and in the confident anticipation of mechanical traction, substantial depreciation and renewal funds, in addition to the statutory sinking fund, were established. The result was—and this is apt to be forgotten—that at the end of seven years of successful horse traction the accumulated reserves practically covered the cost of converting the lines for electric traction, and the continuance of the same reserve and sinking funds, as you all know, resulted at the end of the first sixteen years of ever increasing prosperity under electric traction in placing my good friend and successor, Mr. Dalrymple, in the happy position of being able to announce an accumulation sufficient to wipe off the whole capital of close upon £4,000,000.

I have only a few words more to say on the long view. Even with horse traction the view taken by the Corporation was that while the city proper was their first and chief charge, it was sound business to extend the benefits of the Glasgow tramways to the surrounding

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communities. From that time powers to this end were obtained with the good will and co-operation of the neighbouring authorities. But the advent of electric traction disclosed a greatly wider sphere. The results and potentialities it brought were such that one could scarcely escape the conviction that it had now become the reasonable function of Glasgow tramways, in the broad interests of the larger community, and on fair terms, to make the system available to a greater extent for linking up the surrounding populous places in the Clyde area with the city which forms the chief centre of attraction and influence. The Corporation of Glasgow as usual took the long view. In the next few years, and with general approval, negotiations had been carried through, and powers obtained for extensions to Renfrew, Paisley, Giffnock, Rouken Glen, Cambuslang, Uddingston, Bishopbriggs, Dalmuir, and other places, in addition to needful extensions within the city. Construction followed closely, so that I had the satisfaction of seeing the new programme well on its way to fulfilment. And we know that to this day the larger policy has never been lost sight of. I now take the liberty of warmly congratulating the Corporation, the Tramways Committee, and my good and capable friend and erstwhile coadjutor, Mr. Dalrymple, upon their conspicuous success throughout all the later years in the splendid development, up-to-date improvements, and wise extensions of Glasgow's great system of street and road transport. I expect the next news we shall have will be the placing of the contract for the relief bridge over the river. Wonderful progress has indeed been made, and is being made, by the still youthful Glasgow tramways. This progress must continue so long as Glasgow flourishes. By all means let Glasgow and her tramways flourish together.

Mr. James Dalrymple, general manager, Glasgow Corporation Tramways, speaking in reply for the present staff, said they were proud to be privileged to participate in the proceedings of that day. He trusted that the tramways staff would always remember that they were the servants of the citizens of a noble city, and that if they did their work faithfully they would have the respect and confidence and goodwill of the large and growing community whom they served. On that occasion they looked back and took stock of the work they had done, but at the same time they also looked forward with confidence to the days that were to come. They were satisfied that the work which lay before them would be far more interesting and far greater than anything they had yet tackled. (Applause.)

On the motion of **Sir John Ure Primrose,** a vote of thanks was accorded to the Lord Provost for presiding.

About 1,500 guests took part in the reception which was held in the City Chambers in the evening. They were received by Lord Provost Paxton and Mrs. Paxton. Dancing was engaged in, and a programme of music was also submitted.

IMPROVED SYSTEM OF LUBRICATION.

A system of lubrication that can be depended upon to reduce friction to a minimum and requires little or no attention is an ideal that rolling stock engineers have always had in mind, but with little hope of attainment. From the claims put forward by the Loco and Auto Economy Accessories, Limited, of 25 Victoria Street, Westminster, it appears that with the "Permoil" system of lubrication something approaching perfection can now be realised.

The success of this lubricating system is based upon the use of highly refined mineral oils from which is manufactured a lubricant combining all the advantages of oiling and greasing, and from which is eliminated all foreign matter. This is applied by means of a spirally wound composite fabric pad. The thin layer of lubricant continuously fed from this pad to the bearings and axle surfaces gives the lowest possible coefficient of friction without danger of loss of permanence of the oil film even under the greatest pressure or severest conditions of service. It is claimed for the "Permoil" system that once installed it is practically negligible in operating cost, since it requires no attention over long periods. The company will fit trial axle-boxes free of charge for a suitable test and to give guarantees for entirely satisfactory service.

Railway carriages can be run from one general inspection to another without attention, covering a distance of from 60,000 to 90,000 miles, while tramcars can be run up to 90,000 miles with one application of the lubricant, which means a period of from three to five years. Although intended particularly for railway and tramway service, "Permoil" lubricant can be employed wherever the usual oils and greases are used.

In addition to the "Permoil" lubricating system the company stock an excellent range of motor accessories of high quality and accuracy. Amongst these may be mentioned dashboard mileage recorders, hub mileage counters, dashboard clocks, thermo gauges, distance gauges, pressure gauges, lubricators and compression taps, adjustable lamps, etc.

MELBOURNE TRAMWAYS ELECTRIFICATION.

SIXTY NEW CARS ANNUALLY FOR FIFTEEN YEARS.

Inquiries of the Melbourne and Metropolitan Tramway Board in regard to future tramway construction and the conversion of the cable tramways indicate, says the *Melbourne Argus*, that it is unlikely that large operations will be undertaken immediately. The Board has an arranged scheme involving a fifteen years' programme, and the only work likely to be taken in hand before the end of this year is the construction of a short connecting route of cable tramway. When this work is finished the Board will proceed with electrification. The first section to be dealt with will be the section of cable line in Swanston Street North, between Queensbury Street and Lonsdale Street, so as to enable the terminus of the Coburg electric tramway to be extended south to a point nearly opposite the Melbourne Hospital entrance. As this is merely conversion work, no special authority of Parliament is required. In respect to the third section of immediate tramway construction, the building of the city end of the West Brunswick route along Peel Street into William Street, the Parliamentary Standing Committee has taken evidence, and will submit a report to Parliament during the coming session. Parliamentary authority for the construction of the line is expected towards the end of the year.

During the next fifteen years the Board estimates that an expenditure of £6,200,000 will be required in the conversion of the metropolitan cable system to electric traction and the construction of new electric lines. Of this sum the amount chargeable to conversion, which it is thought should come out of the Board's reserve and renewal funds, is £4,200,000.

During the next fifteen years it is proposed to convert the whole of the metropolitan cable system with the possible exception of the city section of Collins Street, Bourke Street, and Elizabeth Street. The route mileage of electric lines will then probably be as follows—Converted electric lines, 40 miles; present electric lines, 64 miles; Essendon tramway, 11 miles; new routes, 30 miles; a total of 145 miles.

On an estimate of at least 6·3 cars per mile of route, 915 cars will be in service in fifteen years' time. Allowing 10 per cent. for spare stock, and subtracting the 201 cars now available or under construction, a minimum number of 805 cars remains to be built in fifteen years, or fifty-four per annum. The Board will be forced to construct annually nearly sixty cars, of which only about thirty cars can be built in its own workshops. The policy of the Board (which was outlined in a notice in our issue of July 29) is to construct about thirty cars a year in its own shops, and to invite tenders for the construction of about thirty cars annually.

RAIL GRINDING.

The treatment of rails by means of grinding wheels and blocks in reciprocating machines has of late years come more than ever to the front and to-day is a problem of interest to every tramway engineer. In the removal of corrugations, joint grinding, deepening grooves, etc., the use of abrasive wheels and blocks are the means by which these effects of depreciation can be most successfully overcome. It is only by making a special study of this field of operation that some of the leading British manufacturers of abrasive products are now in a position to supply wheels and blocks of a very high degree of efficiency, and it is surprising how economically these deal with modern high silicon and manganese steel rails and switches.

Messrs. Luke and Spencer, Limited, of Broadheath, Manchester, who have for nearly 50 years been continuously making grinding wheels and blocks at their works at Broadheath, are to-day producing these articles, which are dealing with marked success with tramway track both at home and abroad.

These have been made with the object of overcoming the old trouble of "loading" or glazing, which leads to over-heating, breakage, and waste of time and material. The "Lukspenite" wheel is a fast cutting wheel, which requires a minimum of trimming owing to its slow wear and shape-keeping qualities. The remarkable freedom from glazing obviates the necessity of constantly stopping the job for attention to the wheel.

In actual track trials these wheels have come out exceedingly well compared with any previous best. The trials conclusively proved them to have remarkable cutting power and durability, and show that they are a distinct advance in this branch of grinding work.

Gloucester and Brockworth Light Railways.—The Minister of Transport has recently made the County of Gloucester (Gloucester and Brockworth) Light Railways (Revival of Powers) Order, 1922, reviving the powers granted by the Order of 1903, and extending the period for completion.

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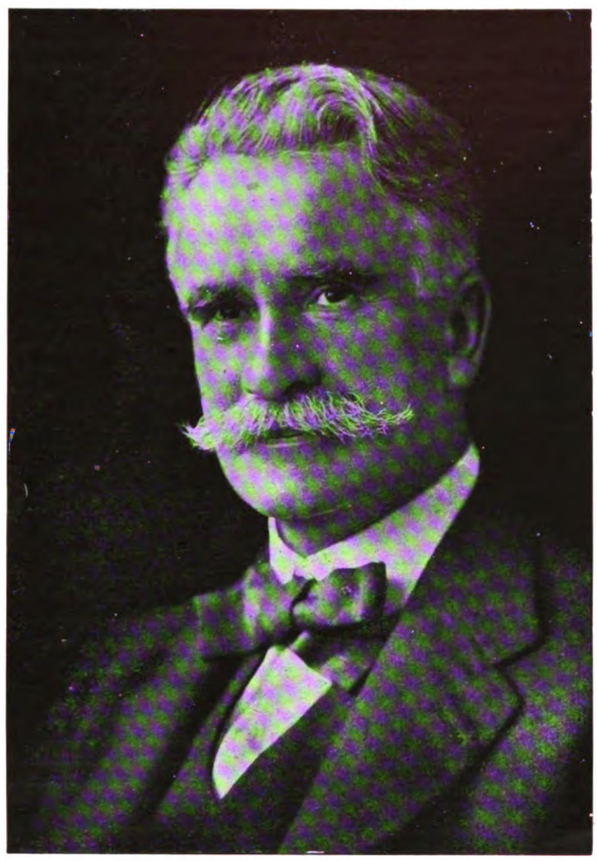
MR. JOHN MOFFAT McELROY.

We reprint by permission from the Journal of the Municipal Tramways Association the following appreciation of Mr. J. M. McElroy by "One Who Knows Him." Many of our readers will readily identify the writer, and they will join with us in conveying grateful thanks to him for the admirable and intimate way in which he has expressed the feeling towards Mr. McElroy that is shared by every one acquainted with his work and career.

"Every tramways manager in the British Isles, and many others as well, will deplore the retirement of Mr. McElroy from Manchester, and their good wishes will be with him as he stands down from the command of one of the largest, most efficient, and successful tramways systems in the land, after an unexampled record. Only two systems—those of London and Glasgow—are greater than that of Manchester.

Conspicuous ability and unbounded devotion, hitched to a guileless and unselfish nature, never go unrequited; the high esteem in which he is held universally is well merited. Mr. McElroy is the happy possessor of those inscrutable qualities that force men into leadership. He simply can't help it. Of strong will, powerful intellect, and incisive speech, in counsel and advice he always was as 'one having authority, and not as the scribes.'



Mr. J. M. McElroy.

Of mere time-serving he never knew anything; with such he made no compromise. Indomitable courage in the face of difficulty always carried him through. In battle he was often the chosen leader of the tramways interests, but he never left any bitterness behind. Here's some testimony to his sagacity—Once at an important conference when he had spoken well in his turn, the writer overheard one of the shrewdest of his colleagues remark, 'Just listen to that! He is always once or twice round the course ahead of us all.' Of self-sacrifice he was quite unconscious. The power of concentration is highly developed in him.

Of the indebtedness of the Municipal Tramways Association to his activities it is, by common consent, impossible to speak too highly. From first to last his was a front rank place. He was the first honorary secretary, a post he filled for five years. Since its formation he has been continuously a member of the governing body. In 1906-7 he was its president. His contributions to its literature have been liberal, and the evidences of an analytical mind are written in large letters all over them. His influence has materially helped to roll this Association into a foremost place among Local Government organisations. He was never slow 'to take occasion by the hand' as Tennyson said of another.

In forging the constitution of the National Joint Industrial Council for the Tramways Industry—that modern instrument for keeping industrial peace—he took a leading part, and it is a significant fact that the employees' representatives proposed him as the first honorary president of that body, a position to which he was unanimously elected. He is a member of the Council of the Institute of Transport.

Turning to other considerations, as a patriot, he devoted himself with characteristic vigour to the service of the State during the war, and served the Government at the Admiralty, the Board of Trade, and the Ministry of Munitions.

From 1895 to 1922, a period of twenty-seven years, he was the guiding genius of the City Tramways of Manchester. If you would see his monument in Manchester—well, take the advice inscribed on Wren's resting-place in St. Paul's—'Look around!' In the interests of the passenger transport of that city he was twice in America, and frequently on the Continent. His report, written in the historic year 1914, on 'Manchester's Passenger Transportation Problem,' is a classic of its kind, and is eloquent evidence of his industry, ability, and wide outlook. For full forty years he has served the city, having had fifteen years' experience in the Highways Department, which then maintained the permanent way, prior to taking up tramway work.

As a colleague and companion, he is a man of much charm of character, which calls forth the affection of his intimates. It is true to add that by his friends he is admired, and by all his acquaintances, respected.

It is a pleasure to know that he is making progress towards his normal health. We will hope to see and hear him again, after some respite from a strenuous life, and trust that he will emerge now and then in the familiar role of counsellor and friend, and, may be, also of adviser and arbiter of ripe experience.

We shall miss his sound advice and stimulating criticism. Both as a 'pillar' and 'buttress' he has been a tower of strength to the Executive Council. Future conferences will be poorer if his chair is vacant. Let us hope that it may be occupied at least once more in September next at Newcastle-upon-Tyne.

We will, meantime, bid *au revoir* but not good-bye to one who has played well his part.

Philip James Bailey makes "Festus" say—

'We live in deeds, not years;
In thoughts, not breaths;
In feelings, not in figures on a dial.
We should count time by heart-throbs.
He most lives who thinks most, feels the noblest, acts the best.'

As long as courage and fidelity are counted virtues will the name of John Moffatt McElroy be mentioned with honour by the Municipal Tramways Association."

MANCHESTER CORPORATION TRAMWAYS.

PRESENTATION BY THE TRAMWAYS COMMITTEE TO MR. MCELROY.

Mr. J. M. McElroy was presented by the Tramways Committee, in July, with a silver tea service. The presentation, which took place at the Tramways Office at the conclusion of the business of the committee, was made by the Chairman (Alderman James Bowes), in the presence of the Lord Mayor of Manchester, the Town Clerk and the members of the committee.

The Chairman spoke of his long and harmonious association with Mr. McElroy, and said that the parting from their late manager was a real wrench for him. He hoped that Mr. McElroy, as a result of his well-earned rest, would be so restored to health as still to be able to do much useful work for the industry in which he had been such a prominent figure.

The Lord Mayor also paid a high tribute to Mr. McElroy for his services to the Corporation of Manchester, and also to the tramway industry generally. He referred particularly to the report which Mr. McElroy had written on the "Passenger Transportation Problem" which he (the Lord Mayor), described as a text-book on the subject, and one of which Mr. McElroy and the Corporation had every reason to be proud. Several of the members of the Committee also added their testimony to the great work which Mr. McElroy had done for Manchester in connection with the organisation and administration of the tramways, and emphasised the very high example he had set by his personality during his period of office as general manager.

Mr. McElroy, in responding, thanked the committee for their kindness in making the presentation to him, and alluded to the happy relations which had always existed between the committee, the staff and himself during the 22 years he had been the manager. Although the parting was a sad one for him, it was made glad by the manifestations of goodwill which he had received from the members of the committee assembled there.

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The Managers' Section of the Municipal Tramway Association at Glasgow.

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FINANCIAL REPORTS AND MEETINGS.

MATHER AND PLATT LIMITED.—An interim dividend of 3 per cent. tax free, has been declared.

CHATHAM AND DISTRICT LIGHT RAILWAY COMPANY have announced an interim dividend of 5 per cent. on the ordinary shares, less tax.

LIVERPOOL OVERHEAD RAILWAY COMPANY.—The directors have announced that they are unable to declare an interim dividend either on the preference or the ordinary shares.

MAIDSTONE CORPORATION TRAMWAYS.—The accounts for the year ended March 31 show a profit of £1,373, of which £321 represents a rebate on current used in a previous year.

METROPOLITAN RAILWAY COMPANY.—The dividend for the six months ended June 30 is at the rate of 2½ per cent. per annum on the ordinary stock. A year ago 1¼ per cent. was paid.

HONG KONG TRAMWAYS.—The Local Board in London have received telegraphic advice from Hong Kong that the directors have declared an interim dividend on account of 1922 of 1s. per share.

THE BRISTOL TRAMWAYS AND CARRIAGE COMPANY LIMITED.—The directors have declared an interim dividend for the half-year ended June 30, 1922, at the rate of 3 per cent. (free of income tax) on the ordinary shares.

KALGOORLIE ELECTRIC TRAMWAYS.—The accounts for 1921 show gross receipts of £28,632 (against £37,530), and net profits, before charging depreciation, £5,817 (against £8,742), making debit balance of profit and loss, after charging debenture service, £54,520.

LONDON, BRIGHTON AND SOUTH COAST RAILWAY.—A dividend for the half-year ended June 30 will be 1¼ per cent. on the undivided ordinary stock and 2½ per cent. on the preferred ordinary stock. A year ago the dividend on the former stock was 1 per cent. and on the latter 2 per cent.

DUBLIN UNITED TRAMWAYS COMPANY.—The directors have declared a dividend at the rate of 6 per cent. per annum, less income tax on the preference stock, and an interim dividend at the rate of 3 per cent. per annum, less income tax, on the ordinary stock for the half-year ending June 30, 1922.

BIRMINGHAM AND MIDLAND MOTOR OMNIBUS COMPANY.—The net receipts for 1921 were £78,699, and £11,645 was brought forward, making £90,344. A sum of £25,000 is placed to reserve, and a dividend is declared on the ordinary shares of 10 per cent., plus a bonus of 5 per cent. The amount carried forward is £22,171.

YORKSHIRE (WOOLLEN DISTRICT) ELECTRIC TRAMWAYS.—The receipts for 1921 amounted to £124,331, as compared with £125,161 in the previous year. After deducting all charges, setting aside £15,000 to renewals fund, and adding £9,357 brought forward, there is an available balance of £18,238. A sum of £5,000 is transferred to reserve, and £13,238 is carried forward.

NEW GENERAL TRACTION COMPANY.—The profit for the year ended March 31, 1922, was £9,999, plus £9,813 brought forward, making £19,812. The directors recommended a dividend of 4 per cent., less tax, carrying forward £9,332. In view of amounts required for reconstruction of track and renewal of equipment, the directors of the Norwich Tramways again considered it wise to transfer the whole balance of profit to reserve for these purposes.

WEST HARTLEPOOL CORPORATION TRAMWAYS and omnibuses show a deficit on the past year's working of £4,787, which will be made good from the reserve fund. The revenue from the tramways was £43,945, and the working expenses £38,058, but provision for interest and redemption of loans converts the surplus indicated into a deficit of £2,064. In regard to the omnibuses there is an actual loss on the working of £753, which is increased to a deficit of £2,723 after payment of interest and redemption.

SINGAPORE'S ELECTRIC TRAMS.—The debenture-holders of Singapore Electric Tramways are informed, in connection with the negotiations with the Shanghai Electric Construction Company, Limited, for the reorganisation and financing of the company, that a provisional arrangement, which the trustees for the debenture-holders and the committee of debenture-holders are prepared to support, has been arrived at with the Construction Company, subject *inter alia* to such modifications of the concession and the conditions of working as the latter company may consider essential.

COLCHESTER CORPORATION TRAMWAYS.—In his annual report for the year ended March 31 last the general manager and engineer (Mr. R. C. Bullough) states that the total revenue was £21,216, a decrease of £3,711 on the previous year. The gross profit was £1,630, which was sufficient to pay interest on capital (£1,341) and £289 towards the £319 required for income tax. The deficit was £3,232, as compared with £2,474 last year. The mileage run was 304,717, a decrease of 22,919. The deficit is attributed to a combination of exceptional circumstances including the coal strike and the depleted military garrison.

SUNDERLAND CORPORATION TRAMWAYS.—The annual report of the general manager and engineer, Mr. A. R. Dayson, for the year ended March 31, 1922, shows that there was a balance carried to net revenue account of £20,664. After deducting interest on capital, bank interest and income tax, there remains a balance for transference to the appropriation account of £8,757. The total income amounted to £138,820, and the aggregate working expenses £118,156, or 19.137d. per car mile. The passengers carried numbered 27,212,579, and the average traffic revenue per car mile was 22.1d. (These figures correct in some particulars those which appeared in our issue of July 8).

UNITED ELECTRIC TRAMWAYS AT MONTEVIDEO.—The profit for the year ended March 31, 1922, after providing for administration expenses and charging £46,418 for debenture interest, was £26,194, to which is added £8,477 brought forward, making £34,671. A sum of £5,090 is carried forward, and the Board consider that under circumstances at present prevailing in Montevideo, the results do not allow of any dividend on the ordinary shares. The company is suing the municipality for its seizure of the company's undertaking, following a strike by the employees. The intervention by the municipality lasted from February last until June 1.

WALSALL CORPORATION TRAMWAYS.—The report of the general manager and engineer, Mr. C. Burgess, for the year ended March 31, 1922, shows a net balance of £3,987 on the operation of the tramways and a net deficit of £3,654 on the motor omnibuses. The total income of the tramways was £85,515, and the aggregate working expenses £68,195, leaving a gross balance of £17,320. Included in the expenditure is a sum of £6,128 towards the redemption of debt, and £8,281 interest on capital. The average traffic revenue per car mile (tramways) was 25.345d., and the average working expenses per car mile, including power cost, were 20.462d. The passengers carried numbered 9,158,260, and the gross car mileage was 858,365.

WOLVERHAMPTON CORPORATION TRAMWAYS.—The annual report for the year ended March 31 last, of the general manager and engineer, Mr. C. Owen Silvers, shows that the gross profit on the tramways was £26,679. To this sum should be added the balance of £3,182 on the motor omnibuses, giving a total of £29,861. After allowing for interest on capital, income tax, and repayment of loans, there remains for appropriation to reserve and renewals fund a sum of £7,599, compared with £3,281 for the previous year. The average traffic revenue per car mile was: tramways, 22.936d.; omnibuses, 21.453d., and the average working expenses per car mile, including power cost, were 18.042d. and 16.461d. respectively.

SHEFFIELD CORPORATION TRAMWAYS AND OMNIBUSES.—The report presented by the general manager (Mr. A. R. Fearnley), for the year ended March 31, 1922, shows that on the tramways there was a total income of £903,427. The expenditure amounted to £697,087, a decrease of £120,225 on the previous year. The gross profit was £206,340, on which there are charges amounting to £123,218 for repayment of loans, sinking fund and income tax, leaving a balance on the year's working of £83,121, an increase of nearly £11,000 compared with last year. The balance has been appropriated as follows: Street improvement—proportion of service of debt, £7,920; renewals fund, £60,340; special purposes fund, £2,000; contribution of capital outlay, £1,416; accumulated surplus fund—interest on investments and bank interest, £829; retention re improvements Committee's proportion—cost of Upwell Street Bridge, £4,121; transferred to city rate account, £6,495. The average cost per car mile was 16.848d., compared with 17.980d. in the preceeding year. The motor omnibus section shows an income of £105,076, of which £104,485 was traffic revenue, and a total expenditure of £97,493, leaving £7,582 gross profit. Charges on this account total £6,534, £1,047 being transferred to the special reserve fund.

BELFAST CITY TRAMWAYS.—Councillor Turner (chairman of Belfast City Tramways Committee), informed the City Council that the accounts showed a total revenue for the year ended March 31, 1922, of £655,329, an increase of £54,145 as compared with the previous year. The working expenses amounted to £479,251, a decrease of £24,303. The items contributing to this were as follows—Traffic expenses, £231,537, a decrease of £1,480; general expenses, £39,570, an increase of £7,281; general repairs and maintenance, £111,419, a decrease of £23,730; power, £86,824, a decrease of £12,268. The balance carried to net revenue account (including £2,815, bank interest), amounted to £178,893, an increase over 1921 of £75,899. Against this account the following standing charges were to be debited—Interest, £58,925; sinking fund, £42,427; income tax and sundry charges, £20,748; and depreciation and renewals, £25,000—a total of £147,100, against £142,629 for 1921. After providing for all these charges there was a surplus for the year of £31,793, which had been applied in reducing the debit balance of £39,635 carried forward from the previous year, and now left £7,842 to the debit of appropriation account at March 31, 1922. Councillor Turner pointed out that the prolongation of the Curfew Order, the unsettled state of the city and the continued unemployment had a most detrimental effect on the financial results. It was intended to proceed with the second year's track reconstruction programme, covering a further ten miles, and the Council agreed to accept the tender of G. Percy Trentham, Limited.

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TRAMWAY AND LIGHT RAILWAY NOTES.

ASHTON-UNDER-LYNE.

PENNY FARES ON TRIAL.

A six months' trial of penny minimum fares is being made on the Ashton-under-Lyne Corporation Tramways, in place of the 1½d. minimum which has been in vogue for a long time.

BIRKENHEAD.

QUEUES AND PARCELS.

The Tramways Committee propose to obtain powers to use the tramway cars for the conveyance of parcels, etc., and to form and control queues of passengers waiting for tramways and omnibuses.

BIRMINGHAM.

TRAMWAY EXTENSIONS ON SLEEPER CONSTRUCTION.

The city surveyor reported at a recent business meeting that preparations for the construction of five miles of tramway between Selly Oak and Lickeys had been completed, and instructions were given for the laying of the tracks as soon as possible. These will be laid on sleepers in the method described in the article published in THE TRAMWAY AND RAILWAY WORLD of July 15, 1922, and will be put down at the side of the road. The work will afford employment for a large number of men.

BRADFORD.

NEW TRAMWAY TERMINUS IN FORSTER SQUARE—EMPLOYEES AND SLIDING SCALE.

Good progress is being made with the scheme to construct an "island" terminus for the tramways in Foster Square. Under existing conditions nine tramway routes have their city terminus at different points in or near the Square, and the presence of so many queues on the footpath involves an undesirable degree of congestion. By the new scheme eight of these termini will be concentrated round the central "island," where queues will be formed in appropriate barriers. The exception will be the Eccleshill route terminus, which will be at the junction of Bolton Road and Forster Square. Provision has been made for cars serving through routes to pass through the Square. The reorganisation does not necessitate much alteration to the centre of the Square itself; the existing tracks have, however, to be taken up and relaid in their new positions. The tramway employees have resolved to support the Transport and General Workers' Union in any step they may take toward resisting the action of the employers in giving notice to abolish the sliding scale agreement. The action is described by the Bradford men as "this unjustifiable and unwarrantable attack upon the standard of life of tramway workers."

BURTON-ON-TRENT.

LOSS ON PENNY FARES.

A loss of about £800 in three months has been occasioned by the penny fares on the Corporation tramways. It is proposed therefore, to abolish them and to reduce the 2d. charge for most of the longer stages to 1½d.

BLACKBURN.

ADVERTISEMENTS PLACED ON THE CARS.

The Corporation recently refused to allow advertisements to be displayed on the tramway cars, but it has now decided to make a twelve months' trial of advertising. As a result the income of the tramway department will be considerably increased.

CARDIFF.

NEW OMNIBUS SERVICES.

Mr. R. L. Horsfield (general manager of Cardiff Corporation tramways) has reported to the Committee that in connection with the taking over of the Whitchurch motor omnibus service it had been agreed to pay the Cardiff Tramways Company, the vendors, £6,000 for their land and buildings at Llandaff North. The Corporation are not taking over the company's vehicles, and the Tramways Committee decided to invite tenders for new omnibuses for this service. It was also decided to apply for sanction to borrow £6,120, with an additional £200, for certain fixtures and machinery at the company's depot.

DUBLIN.

OFFICES DESTROYED. SERVICES CONTINUED IN DANGER ZONE.

The offices of the Dublin United Tramways Company in Sackville Street East, Dublin, were completely gutted by fire in the course of the recent civil warfare in the city. The tramway services were maintained to a large extent outside the areas affected by the fighting, but towards the centre of the city the overhead wires were cut in many places by gunfire. The work of repair is being rapidly pushed forward. Much credit is due to the management and staff of the company for the persistency with which they endeavoured to continue transport facilities under most difficult conditions. The *Freeman's Journal* says: "A special word of praise is due to the employees of the company who ran the cars through the danger zones up to the time when it became imperative that the service should be suspended."

EDINBURGH.

GRADIENTS AND DOUBLE-DECK CARS—SUNDAY WORK—PROPOSED GEORGE STREET LINE ABANDONED.

The Town Council have confirmed the Tramway Committee's recommendation that top-covered double-deck cars with slipper brakes be used on the northern routes of the city. Mr. Mancor (convener of the Tramways Committee), replying to criticisms that such cars would be unsafe in view of the gradients on these routes, said the Ministry of Transport had already approved the type of car proposed, and also had sanctioned the most dangerous bend in the city—at York Place—with the condition that there must here be a compulsory stop. Most of the tramway accidents that occurred resulted from the remissness of drivers. Edinburgh, like everywhere else, must take a measure of risk. Otherwise there was no danger. They could collect the fares on the single-deck car much easier than on the double-deck type, but the loss would be more than compensated for by the carrying capacity of the car. At a joint meeting of Edinburgh Corporation Tramways Sub-committee and representatives of the employees, Councillor Mancor, convener of the Tramways Committee, said they realised that time and a half for Sunday work was a time-honoured practice, but in view of the increased wages and the persistent demands for a reduction in fares, it was felt that the best the committee could do was to give a rate of time and a quarter. The committee had agreed, however, to pay double time for the New Year's holiday. The convener also pointed out that the basic rate of pay for 1922 was approximately 140 per cent. above that of 1914. Edinburgh Town Council have decided to delete from their Provisional Order the clauses relating to the proposed tramway from St. Andrew Square along George Street to Charlotte Square.

EXETER

TRAMWAY STANDARDS NOT SUITABLE FOR ADVERTISEMENTS—DEPOT EXTENSION.

The Town Council has accepted the report of a Special Committee recommending the Council not to allow advertisements to be placed on the tramway standards. One member said that he would prefer to pay the penny rate that it was estimated the advertisements would provide rather than see the standards disfigured. The Tramways Committee have recommended extensions to the car depot estimated to cost £2,350.

GLASGOW.

TRAMWAYS JUBILEE—EXTENSIONS—FARE REVISION.

The jubilee of Glasgow Corporation tramways was celebrated on August 19. The Corporation were recommended to offer a gift of £1 to every employee of the department. On the date mentioned members of the Corporation and certain invited guests were entertained at luncheon, and a reception and dance given in the Banqueting Hall, City Chambers. The first horse-drawn cars were operated by the Glasgow Tramway and Omnibus Company in 1872, under a lease from the Corporation. The Finance Sub-Committee of the Glasgow Corporation Tramways department has instructed the general manager to submit a full report on the question of fares, with a view to an all-round revision. The tramways from Garngad terminus to Provanmill, a distance of 1 mile 85 yards, has been opened for traffic. When the Corporation Order Confirmation Bill was read a third time and passed in the House of Lords on July 10, a clause was deleted which enabled surrounding local authorities in whose areas will be some of the tramways proposed by the Bill to purchase such tramways after the expiration of 42 years.

HUDDERSFIELD.

TIME OF WORKMEN'S TICKETS—MOTORMEN AS OMNIBUS DRIVERS—BONUSES.

Having considered the question of extending the time for the issue of workmen's tickets from 8 a.m. to 9 a.m., the Huddersfield Committee resolved at their last meeting that they could make no alteration, being of the opinion that the loss of revenue would jeopardise the service. Replying to Councillor F. Wood, who asked if the motormen of the tramcars had an opportunity of learning to drive motor omnibuses, Councillor Canby said that so far as possible the Committee selected the most suitable men in their employ for the work, but at the beginning they might naturally have to take on one or two outsiders. On the subject of a bonus to drivers it was resolved that a draft scheme be prepared for the consideration of the committee, with a view to its being brought before the General Purposes Committee.

HULL.

PERMANENT WAY PROPOSALS.

The Corporation Tramways Committee propose to apply to the Ministry of Transport for sanction to borrow £29,000 for the renewal of the track in Hessle Road between Walker Street and Dairycoates. The city engineer and the tramways manager reported that the rails were laid down between 1898 and 1902, and they required renewing at once. The city engineer was instructed to submit an estimate for the work and to invite tenders from three firms. It was decided also to seek financial assistance from the Unemployment Grants Com-

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mittee. The Ministry of Transport have given their consent to the proposed laying of a double line of tramways in place of the existing single line in Osborne Street, but they have refused sanction to the borrowing of the money for the scheme, and on this account the work is not yet to be undertaken.

KEIGHLEY.

The Town Council propose to purchase, at £1,575 each, the two motor omnibuses, which they have at present on hire, for use on the Oakworth trackless route. As an experiment one of the trolley vehicles will be converted from the present wheel motor drive to the back axle drive at an estimated cost of £525. An electric arc welding plant is to be purchased at an estimated cost of £316, and will be used to weld the tramway rails where the foundations are good, and it is expected that when this work has been done the track will be in a condition for use for a considerably longer period. The Tramway Committee recommended some months ago that £40,000 should be borrowed for the reconstruction of about two miles of single track, but the proposal was rejected by the Town Council. The matter will, however, have to be considered again shortly.

LEEDS.

Insurance of Employees.

Alderman R. A. Smithson, chairman of the Tramways Committee, at the July meeting of the City Council urged the Finance Committee to consider the possibility of reducing the basis of the Tramways Committee contribution to the fund established to meet claims in respect of accidents to employees. The tramways paid at the rate of 27s. 6d. per cent., but they could get the risk covered by insurance companies at from 4s. 6d. to 12s. 6d. per cent. The liabilities of the tramways had been so small that a substantial reserve had been built up. The Tramways Committee might easily save £4,000 or £5,000 a year on this payment and the saving would help to wipe out the deficit on tramway working and to revise the fares. Alderman Wilson, chairman of the Finance Committee, replied that the charge to the Tramways was 25s. per cent. for the whole of their risks. As fresh liabilities were being put upon the fund he could not say yet whether the rate could be reduced. The total income of the fund had been £97,000, while £43,000 had been paid out, £5,000 spent on management and £48,977 placed to reserve. He could not agree that almost the whole of the reserve had been made out of the tramways. That committee's claims amounted to 32 per cent. The Finance Committee would consider the appeal.

LEICESTER.

Charge for Electric Energy Supply to Tramways.

The Town Clerk of Leicester (Mr. H. A. Pritchard) and the City Treasurer (Mr. W. Penn-Lewis), reporting to the City Council with respect to the charge for current supplied to the Tramways Department for the year, have arrived at the conclusion that the charge to be made to the Tramways should be taken for the year at 1·94d. per unit.

LIVERPOOL.

Additional Sleeper Track Construction.

The Works and Streets Sub-Committee of Liverpool Health Committee on July 20 visited the line of route of the new road from the city to Knotty Ash, Prescot, when the city engineer (Mr. J. A. Brodie) described the progress of the scheme. The plan includes the construction of a new double tramway track laid on sleepers for express running which is more easily achievable because of the infrequent stopping places. Mr. Brodie stated that the work is the result of collaboration between the Corporation, the County Council and the Ministry of Transport. The county authorities were constructing the road and Liverpool the tramway track, the Ministry defraying half the cost. The construction of the sleeper track would cost only half as much as if it had been of the paved type, and this saving had enabled the tramway committee to purchase sufficient land on each side of the track for the new road. Before the end of the year it is hoped to start work on a sleeper track on grass in Muirhead Avenue, which is 120 ft. wide, and is to be extended in consequence of the resumption of house building.

LONDON.

An Inquiry into Fares—Route Indicating Machine.

At a recent meeting of the London County Council, Mr. C. W. Matthews, chairman of the Highways Committee, said that workmen's fares are in force on the Council's tramways as they have been for a long time past. The Highways Committee were inquiring carefully into the question of the remunerativeness or otherwise of the fares at present charged, how they compare with the workmen's fares in operation on other traffic systems, and whether any modification of the present basis of charges is desirable or possible, having regard to the financial position of the tramways undertaking. The question was an important one, which called for the most careful consideration and he could not say when the Committee's inquiries into the matter would be completed. Experiments are being made on the London United and the Metropolitan Electric Tramways with a route-indicating device known as the "mileometer." The object of the machine is to indicate to the passenger at any given moment the exact spot on the route at which the car has arrived. The mileometer consists of a moving tape, running on rollers which are geared, and a pointer showing the constantly changing position of the vehicle. Discs on the tape mark the stopping places, cross-roads, fare-stages and such other landmarks as may be helpful to the passenger. The visible portion of the tape always gives the half-mile of the route in advance and the half-mile just traversed. The machine would appear to be of most use to strangers who are desirous of alighting at a spot with which they are unfamiliar. It might also tend to eliminate the practice to "over-ride."

MANCHESTER.

Coroner's Warning.

The Manchester City Coroner, in cautioning a tramcar conductor at the inquest on an old lady who died in consequence of the premature starting of a car, said that he should be very careful indeed when people—especially old folk—were boarding cars.

MIDDLESBROUGH.

New Tramway Depot.

The new depot, offices and shops of Middlesbrough Corporation Tramways in Parliament Road were formally opened on July 19 by Councillor Edwin Turner (chairman of the Tramways Committee). The new buildings cover an area of 14,250 square yards, and the total cost of their erection and equipment amounted to £30,652. It will be remembered that the Middlesbrough Corporation, together with the municipal authorities of Stockton and Thornaby, took over the Teesside undertakings of the Imperial Tramways Company (Limited), in April 1921.

NEWCASTLE-ON-TYNE.

New Tramway Authorised—Gosforth Park Extension.

The Ministry of Transport has authorised the Corporation to proceed with a scheme which was first planned years ago, and the completion of which will add largely to the popularity and convenience of the tramway service. The new line will run through Gosforth Park and link up with the existing lines at either end of the Park. The Corporation track at present extends from the city to Henry Street, Gosforth, whence the Corporation have running powers over the lines of the Tyneside Tramways and Tramroad Company to the main entrance of Gosforth Park. The proposed extension provides for the construction by the Corporation of about 100 yards of track on the main North Road, from the Tyneside Company's line, with which it will connect. The new line will then proceed through the Park to Blackroad Plantation, to link up with the Westmoor extension of the city tramways on the Great Lime Road. The double line of track through the Park will be laid on sleepers. The extension will be about 1½ miles in length and will make possible a circuiar route through pleasant rural scenery. The estimated cost of the work is approximately £50,000. The Ministry of Transport has also given the Corporation authority to proceed with the construction of a track from near the present Slatyford terminus to Denton Bank on the West Turnpike, a distance of about a mile.

PONTYPRIDD.

Sunday Tramway Service.

The Rhondda Tramways Company has made arrangements with the Pontypridd District Council to run over their track to the centre of Pontypridd on Sundays. The company will pay to the Council £500 per annum for the privilege. There will be no other tramway services in Pontypridd on Sundays.

PLYMOUTH.

New Tramway Offices.

The Corporation Tramways Committee have decided to construct new office accommodation at the Milehouse depot.

SHEFFIELD.

Low Working Expenses—Chairman Compliments the Manager and Staff.

Sir William Clegg, chairman of the Corporation Tramways Committee, commenting on the financial results of the working of the department for the past year (summarised in our issue of July 15), said: "I am informed by the general manager, Mr. A. R. Fearnley, that our working expenses are lower than those of any municipal or private undertaking in the United Kingdom." A Labour member warmly congratulated Sir William on the balance sheet, and the chairman of the committee replied that the good results were largely due to "the splendid efficiency of the general manager and his staff."

WOLVERHAMPTON.

Successful Change to Overhead Working—Effect of Fare Reduction.

Alderman Sir S. Craddock, chairman of the Wolverhampton Tramways Committee, when presenting the annual report to the Council, expressed his appreciation of the efforts of Mr. C. O. Silvers, tramways manager and engineer, and his staff to effect the change over from the surface contact system to the overhead system. It had been very successfully accomplished, and there was no dislocation in the service.

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The reduction of the minimum fare from 2d. to 1½d. is at present involving a loss, but the Tramways Committee anticipate that the reduction will be justified.

WALLASEY.

LONGER PENNY RIDES.

In order to popularise the tramways, especially among residents going short distances within the borough, the Wallasey Tramways Committee have extended the penny stages.

PERSONAL.

Mr. A. M. Sillar has been elected chairman of the Association of Consulting Engineers for the ensuing year.

Mr. T. Potts, manager of Doncaster Corporation tramway, has been granted an increased salary by instalments to £500.

Mr. F. A. Fitzpayne, deputy tramways manager of Edinburgh, has been granted an increase in salary from £570 to £625 per annum.

Mr. A. A. Watkins, who, before going to Australia, gained experience of tramway operation in Great Britain, has been appointed chief engineer of Adelaide municipal tramways.

Councillor A. S. Dutton has been appointed chairman of the Chester Corporation Tramways Committee in succession to the late Alderman John Jones. **Councillor A. Hart Davies** has been appointed deputy chairman.

Sir Robert Hadfield has consented to act as President of the Engineers' Club for the year commencing September 1 next. Sir Robert will succeed Mr. E. Manville, M.P., who was the first President of the club.

Mr. H. Mattinson, general manager of the Manchester City Tramways, has been appointed as one of the representatives of the Municipal Tramways Association upon the British Engineering Standards Association.

Mr. R. H. Selbie, general manager of the Metropolitan Railway, has been appointed a director of the company in the room of the Earl of Lauderdale, who has retired owing to ill-health. Mr. Selbie will continue in his position as general manager.

Sir Charles Parsons has received the degree of Doctor of Engineering of Sheffield University. In introducing Sir Charles, Professor Leahy described the invention of the Parsons turbine as the greatest in steam power generation since the days of James Watt.

Mr. R. A. Chattock, chief engineer of the Birmingham Electricity Supply Department, has been elected chairman of the District Industrial Council for the electrical supply industry (Number 5, West Midland). Alderman J. Gregory is deputy chairman.

Mr. Alfred Powell, whose death occurred at Hampstead on June 30, at the age of 87, was formerly general manager of the Metropolitan District Railway Company. Prior to holding that appointment he was, between 1871 and 1885, chief accountant to the company.

Mr. H. Shankland, of the Shrewsbury and Challiner Tyre Company Limited, has been appointed a director of the company. Mr. Shankland has for some years occupied the position of Chairman of the Solid Tyre Committee of the Society of Motor Manufacturers and Traders

Presentation to Captain Jackson.—At a meeting of the staff of the Sheffield Tramways and Motors Department, on August 12, a presentation was made to Captain Jackson, M.C., who is leaving the department to take up an appointment of general manager at Keighley. Captain Jackson was the recipient of a handsome mahogany clock, with suitable inscription, and a pair of silver salad servers, which were presented to him by Mr. A. R. Fearnley, general manager, on behalf of the staff. He referred to the fact that Mr. Jackson had served an indentured apprenticeship with the department, commencing in 1909; had served with distinction in the war, and had since filled in an efficient manner the position of motor omnibus superintendent on the Sheffield system.

CONTRACTS AND ORDERS.

Wallasey Electricity Committee have accepted the tender of the British Insulated and Helsby Cables, Limited, for cable at £3,094 4s. 10d.

Kirkcaldy Corporation have accepted the tender of Fraser and Chalmers, for a 3,000 K.W. turbo-alternator and condensing plant, at £17,127.

Johannesburg Corporation, according to the *South African Gazette*, anticipate purchasing large quantities of tramway track material during the next few years.

Dartford Urban Council have accepted the tender of William Griffiths and Company, Limited, for the reconstruction of the Crayford tramway track at £3,046.

Wellington (N.Z.) City Council have accepted the tender of the Metropolitan-Vickers Electrical Company for the supply of electrical material for the new power-house, at £32,450.

Edinburgh Tramways Committee have recommended acceptance of the tender of McHardie and Elliott, Limited, Edinburgh, for 30 electric car top-covers at £6,600. This was the lowest offer.

Messrs. Elder Smith and Company, of London and Sydney, have obtained a contract from the New South Wales Government Tramway in Sydney for the treatment of rails by the Sandberg "insitu" process.

The English Electric and Siemens Supplies, Limited, have received an intimation from the Great Northern Railway that their tender for the supply of Siemens "Britannia" lamps for train lighting has been accepted.

J. W. Courtenay, Limited, of Amberley House, Norfolk Street, London, W.C., have been appointed sole advertising contractors for Derby Corporation tramways and the Cornwall Enterprise Omnibus Company.

Liverpool Tramways Committee have recommended the acceptance of the offer of Calders, Limited, 1, Dover Street, London, W.1, to supply 11,500 Baltic red-wood creosoted tramway sleepers at the price of 8s. 6d. each.

Brake Equipment for Melbourne Cars.—Reuter's Trade Service states that the Melbourne, Australia, Tramways Board invite tenders, closing on September 13, for 27 straight air brake equipments for tramcars with single trucks.

Wallasey Corporation tramways have accepted the tender of the Scholey Construction Company for one type "W" RWB (Lincoln) welding plant in order to carry out the Lincoln process of joint welding on their tramways.

The Woods-Gilbert Rail Remodelling Company, Limited, 170, Strand, London, W.C.2., have entered into further contracts for welding with the London County Council and the Manchester Corporation Tramways.

Sydney City Council have received a recommendation from the Electricity Committee advising the acceptance of the tender of the General Electric Company Limited, for a 12,000 K.W. turbo-alternator with condensing equipment, at £72,024.

The London and North-Western Railway is adding a steam turbine plant of 20,000 H.P. to Formby generating station and Clayton and Shuttleworth, Limited, have received a contract for five boilers of 40,000 lb. evaporating capacity per hour.

Manchester Tramways Committee have recommended acceptance of the tender of F. Smith and Company (incorporated in the London Electric Wire Company and Smiths, Limited), for copper trolley wire, and that of Collier Brothers for silicium bronze trolley wire.

Newcastle Tramways Extension.—Tenders will probably be invited shortly for the construction of the Gosforth Park extension of the Newcastle Corporation Tramways. Sanction for the construction was given recently by the Light Railway Commission, the cost being estimated at about £50,000.

Trailer Car Shed for London County Council.—Messrs. L. H. and R. Roberts are the successful tenderers for the erection of a trailer car shed for the London County Council at Brixton Hill. The amount of the contract is £14,986. Twenty other tenders received ranged from £16,995 to £20,182.

The Liverpool Corporation tramways authorities have requested Messrs. Scholey Construction Company, Limited, to put a second rail hardening machine into operation immediately. Up to date approximately 17 miles of track have already been treated by the Sandberg "insitu" rail hardening process.

Preston Electricity Committee have recommended the acceptance of the following tenders—English Electric Company, Limited, turbo-generator and condensers; Metropolitan-Vickers Electrical Company, switchgear; Babcock and Wilcox, Limited, boilers, steam pipes etc. The total amount of the tenders accepted is stated to be £248,782.

Liverpool Tramways Committee recommend acceptance of tenders as follows—Walter Scott, Limited, Leeds, 1,500 tons steel tramway rails; Guest, Keen and Nettlefolds, Limited, 45 tons steel fishplates; Houghton and Son, Limited, 45 tons steel tiebars; Bayliss, Jones and Bayliss, Limited, 45 tons steel tiebars and 12 tons mild steel fishbolts and nuts.

The Scholey Construction Company, Limited, 56, Victoria Street, London, S.W.1, have secured repeat orders for the Sandberg "insitu" treatment of 10¼ miles of track on the following tramways—Birmingham, Leeds, Manchester and York. They are also executing extensive contracts for the Liverpool, Newcastle and Hastings Tramways.

The Spearing Boiler Company, Limited, have secured the contract for a complete boiler house equipment, consisting of three boilers, each of a normal evaporation of 50,000 lb., together with Ferguson superheaters, economisers, mechanical stokers, induced draught plant, chimneys, steam, feed and other pipework and ash handling plant for the Stepney Borough Electricity Department.

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French Railway Electrification.—The French Thomson-Houston Company has, the *Financial News* reports, formed in conjunction with Schneider and Company, a new company to electrify the French railways. Orders have been placed with the new company by the Government, the Orleans, the Midi, and the P.L.M. Railway Companies for rolling stock and other materials amounting to over 200,000,000 francs.

Salford Town Council have accepted the tender of the Metropolitan-Vickers Electrical Company for the supply of three 10,000-12,500 K.W. turbo-generators, complete with condensing and house service plant, at a cost of £178,734, for the new Agecroft electric power station. The Council also approved the tender of Babcock and Wilcox, Limited, of London, for six water-tube boiler plants at £132,660, for the same station.

City and South London Railway Reconstruction.—The London Underground Group have announced that in connection with the reconstruction of the City and South London Tube Railway the following contracts have been let—Rebuilding Clapham Common and Clapham Road Stations—the Metropolitan Tunnel and Public Works Company (£140,718); rebuilding tunnels, South Island Place to Stockwell—Perry and Company, Limited (£125,219); Euston to the Angel, Islington—Charles Brand and Son (£174,171).

Messrs. Crompton and Company's tender for the supply of three-phase motors, etc., required for the extension of the central repair depot, has been accepted by the London County Council. The tenders received from six selected firms were as follows—Crompton and Company, Limited, £1,016 0s. 6d.; General Electric Company, Limited, £1,019 9s. 6d.; Metropolitan-Vickers Electrical Company, Limited, £1,116 19s.; Lancashire Dynamo and Motors Company, Limited, £1,149 10s.; Electric Construction Company Limited, £1,166 5s.; Bruce Peebles and Company, Limited, £1,185 18s.

The Scholey Construction Company, Limited, the sole agents in Great Britain for the sale of the RWB (Lincoln) dynamotor, have recently received the following orders—From Messrs. Matherson and Company (Hong Kong Tramways), one type W. dynamotor, maximum capacity 500 amperes, weight 7¾ cwts. net.; Mexborough and Swinton Tramways Company, one type B dynamotor, maximum capacity 300 amperes, weight 5¼ cwts. net; Musselburgh and District Electric Light and Traction Company, one type B dynamotor. The Scholey Company have also secured an additional contract from the Birmingham Corporation Tramways for the welding of an extensive portion of tramway track by the patent RWB (Lincoln) process. Up to the present time over 2,000 joints have been treated on both new and old track in Birmingham.

South African Railways.—The South African Railway Board (as reported in our issue of February 16, 1922), has accepted the tender of the Metropolitan-Vickers Electrical Company, Limited, for electric locomotives for the Glencoe-Maritzburg section at £10,918 per locomotive, with Swiss mechanical parts. The other tenders received were as follows—Metropolitan-Vickers Electrical Company Limited (British), £11,642 (all British manufacture); English Electric Company, Limited (British), £11,554; Allgemeine Elektricitats Gesellschaft (German), £12,947; Siemens Schuckert-Werke (German) £12,947; International General Electric Company (American), £15,105 (converted into sterling at rate of exchange ruling when tenders were under consideration); Armstrong, Whitworth and Company (British), £21,037 (Swiss electrical parts); Brown, Boveri and Company (Swiss), £15,200 (all Swiss locomotives, exclusive of erection in South Africa); Brown, Boveri and Company (Swiss), £11,650 (German mechanical parts, exclusive of erection in South Africa). Except Messrs. Brown, Boveri and Company's tenders, all prices include " erection and starting to work " in South Africa.

PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given in italics.

Applications for Letters Patent.

The number of the patent is given in brackets.

Ventilation of passenger vehicles (18,715)—Bristol Tramways and Carriage Company, Limited, and B. A. Payne.
Motor vehicles (18,251)—P. Crosti.
Control mechanism for motor vehicles adapted for running in either direction (18,338)—Daimler-Motoren Ges.
Elastic fluid turbines (18,448)—English Electric Company, Limited, and G. Arrowsmith.
Car bodies (18,297)—G. Fornaca.
Torque neutralising mechanism for motor vehicles (18,582)—Goodyear Tyre and Rubber Company.

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Drop windows for road vehicles (18,299)—Hickman Body Building Company, Limited, and R. Nixon.
Live axle for motor vehicles (18,671)—F. O. Kekwick.
Gearing for motor vehicles (18,579)—H. Lock.
Device for enabling motor vehicles to travel on railed tracks (18,164)—G. Lynch.
Safety device for arresting trolley wire and automatically readjusting trolley thereto (18,257)—E. E. Mathers.
Change speed mechanism for motor vehicles (18,450)—G. E. Ruckstell.
Bodies of motor vehicles (18,294)—A. T. Sadler.
Emergency axle device for motor vehicles (18,728)—C. H. Shearn.
Speed indicators (19,382)—British Thomson-Houston Company, Limited, and J. Hutt.
Self-starters for motor vehicles (19,259)—M. Evans.
Fuel consumption and distance indicators for motor vehicles (19,159 and 19,160)—J. Higginson.
Road vehicles for passengers (19,495)—London General Omnibus Company, Limited, and G. J. Shave.
Trollies for electric tramways (19,110)—F. McLoughlin.
Trucks for railway, etc., vehicles (19,270)—A. Toms (*J. G. Brill Company*).
Tramway rails (19,239)—J. Walker.
Portable lifting jacks (19,887)—M. H. Barraclough.
Rail joints (19,828)—S. Butler.
Motor omnibuses (19,849)—L. Dewing and G. Page.
Overhead trollies for electric tramways (19,795)—G. P. Gill.
Feed mechanism for strip charts, etc., for tramcars (19,965)—E. W. Lewis.
Mileage indicators (20,132)—S. D. McKellen.
Bearings (19,715)—Metropolitan-Vickers Electrical Company, Ltd.
Route indicators or distance recorders (19,862 and 20,071)—E. Shrubsole.
Braking apparatus for electrically propelled vehicles (20,064)—C. J. Spencer.
Oil level indicator for engines of motor vehicles (19,772)—B. O. L. Williams.
Motor vehicles (19,878)—F. Winterbottom.
Motor vehicles (20,237)—T. F. N. Alexander.
Motor vehicles (20,261)—C. R. H. Bonn.
Arrangement for suspending overhead wires on electric railways (20,458)—Sir P. Dawson and F. W. Fawdry.
Device for supporting overhead wires for electric railways (20,459)—Sir P. Dawson and F. W. Fawdry.
Device to protect omnibus passengers against weather (20,562)—E. C. Fuller.
Motor vehicles for road and rail (20,714)—A. Galbraith, Roadrails, Limited, and R. S. Stromach.
Emergency brake for motor, etc., vehicles (20,498)—S. Griffin.
Omnibus seat (20,504)—G. H. Robinson.
Motor vehicles (20,238)—E. H. Williams.

Specifications Published

1920

Motor vehicles (36,225—*180,711*)—A. E. Alexander (*Three Point Truck Corporation*).

1921

Device for putting derailed cars back upon the rails (10,388—*180,840*)—L. J. E. Boileau.
Variable speed gears for motor vehicles (18,167—*180,925*)—Raleigh Cycle Company, Limited, and W. Wilkie.
Change speed gear for motor vehicles (4,385—*181,057*)—A. R. Mitchell.
Automatic emergency brake attachment (7,009—*181,093*)—A. Toms.
Motor vehicle axles (8,909—*181,149*)—L. James.
Motor vehicles (8,959—*181,152*)—E. Cassalette.
Internal drive rear axle for motor vehicles (9,517—*181,165*)—F. H. Rogers (*White Motor Company*).
Couplings or draw bar connections for motor vehicles and trailers (12,006—*162,295*)—Daimler-Motoren Ges.
Steering wheels of motor road vehicles (22,579—*181,274*)—A. D. Lloyd.
Tyres of tramway wheels (8,012—*181,481*)—Vickers, Limited, and C. L. Sumpter.
Motor vehicles (8,043—*181,485*)—H. Garner, J. P. Garner, and S. Smith.
Tramway rails having removable treads (11,483—*181,554*)—F. Adams.
Bracket arm hangers for supporting trolley wires conveying electric current (28,963—*181,649*)—S. T. Quilliam and A. T. Craston.
Speed controlling devices for tramways (12,131—*162,617*)—E. Rudolausse.
Motor vehicles (12,136—*181,908*)—H. Heal.
Rail joints (18,913—*181,998*)—B. Shores.
Apparatus for dressing tramway rails (33,109—*179,507*)—F. Krupp Akt.-Ges.
Tramway stretcher bars (9,112—*182,183*)—O. R. Williams.
Tramrail (10,333—*182,231*)—J. A. Yeadon.
Gear cases of tramcars (15,285—*182,298*)—R. H. Dickinson and T. C. Winfield.

1922

Arrangement for the recovery of energy in electrical railway systems employing series connected direct-current motors (5,398—*175,992*)—E. Santuari.

89977A

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1921. WEEKS ENDED July 9	July 16	July 23	July 30	Aug. 6	1922. WEEKS ENDED July 8	July 15	July 22	July 29	Aug. 5	AGGREGATE. Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	3.819	4.226	4.450	4.284	4.159	3.822	3.602	4.396	4.250	4.513	9½	35.597	+ 746
Aberdeen Motor Buses	366	410	631	574	433	329	293	570	540	488	9½	3.221	− 639
Ayr Corporation	970	1.240	1.795	1.141	1.184	840	1.116	1,697	1,121	1.067	12	10.474	− 604
Barrow Corporation	999	1.032	1.007	930	951	642	657	659	640	715	18	11.402	− 5.106
Belfast City Tramways	13.131	12.185	11.666	12.063	12 260	11.793	11.324	10.713	11.222	11.692	18	211.077	− 20.282
Birkenhead Corporation	2.707	2.659	2.571	2.585	2.655	2.386	2.367	2.370	2.422	2.422	18⅞	45.116	− 1.392
Birkenhead Motor 'Buses	968	950	943	867	950	796	817	897	956	1.085	18⅞	14.457	+ 203
Birmingham Corporation	29.607	29.233	28.987	28.600	26.320	28.859	28.524	28.007	27.243	27.884	18	518.801	17.886
Birmingham Motor 'Buses	2.295	2.245	2.109	2.009	2.204	1.760	1.879	1.842	1.815	1.799	18	34.182	6.059
Blackburn Corporation	2.491	3.020	2.837	2.569	2.501	2.399	2.441	2.383	2.358	2.348	18½	45.879	+ 4.514
Bradford Corporation	14.830	14.834	13.999	14.499	15.627	13.878	14.374	14.101	13.835	14.313	19	260.290	− 15.859
Burnley Corporation	3.090	3.550	3.318	3.561	3.537	3.305	3.307	3.334	3.228	3.483	—	...	...
Burton-on-Trent Corporation ..	614	643	641	667	738	582	533	599	569	639	18	10.312	− 1.116
Bury Corporation	2.599	2.570	2 482	2.542	2.459	2.401	2.486	2.544	2.489	2.562	18⅞	46.065	+ 1.048
Chatham and District	1.698	1.739	1.696	1.811	2.038	1.749	1.816	1.841	1.881	1.837	31	50.584	− 359
Chesterfield Corporation	1,389	1.258	1.317	1.532	1.655	1.192	1.154	1.171	1.337	1.373	17	21.771	− 2.284
Derby Corporation	2.150	2.290	2.310	2.300	2.471	2.195	2.128	2.120	2.143	2.257	18	39.317	+ 15
Dundee City	3.607	3.504	3.485	3.362	2.925	2.929	2.939	3.165	3.260	2.872	11⅞	34.895	− 4.064
East Ham Corporation	2.282	2.252	2.136	2.136	2.229	2.147	2.075	2.047	2.119	2.111	18½	39.255	+ 431
Edinburgh Corporation	15.146	15.048	15.145	...	...	12.604	12.892	14.708	...	...	10	129.876	− 13.375
Edinburgh Motor 'Buses	4.259	4.157	4.112	...	...	3.617	3.701	4.329	...	...	10	38.581	− 4.138
Glasgow Corporation	46.880	43.245	33.446	37.289	44.215	41.154	39.760	31.156	35.336	41.861	9½	391.783	− 35.788
Glossop (Urban Elec. Supply Co.)...	203	221	204	219	231	211	221	209	222	229	31	7.000	111
Halifax Corporation	4.949	5.116	4.801	4.592	4.982	4.282	4,135	4,445	4.436	4.448	17½	78,127	+ 1.859
Halifax Motor 'Buses	121	124	116	52	63	97	97	95	108	112	17½	1.370	457
Halifax Railless Cars	...	...	...	64	57	31	30	36	25	26	17½	857	+ 735
Huddersfield Corporation	5.632	5.491	5.319	5.553	5.832	5.075	5.376	5.304	5.394	5.620	19	102.790	− 3.712
Ilford U.D. Council	1.606	1.565	1.520	1.514	1.613	1.472	1.438	1.384	1.435	1.409	18½	27.207	− 1.237
Ipswich Corporation	965	1.045	1.019	1.068	1.205	878	867	861	905	943	18	15.531	117
Isle of Thanet...	1.810	2.206	2.488	2.703	3.485	1.680	1.913	1.881	2.304	2.527	43½	39.605	− 1.178
Kilmarnock Corporation	369	378	404	426	362	334	344	359	366	286	11½	3.941	− 556
Leicester Corporation	7.282	7.386	7.831	7.268	7.094	7.567	7.418	7.616	7.318	7.319	31	228.504	+ 35.390
Liverpool Corporation	33.090	32.204	31.926	31.105	31.455	30.977	30.504	29.428	29.186	30.019	31	910.050	− 26.742
London County Council	108.189	107.543	103.853	102.637	104.162	95.794	93.757	93.054	93.787	93.195	17½	1.677.678	157,603
Maidstone Corporation	576	506	524	497	608	563	482	498	486	489	17½	8.927	+ 43
Manchester Corporation	42.189	40.329	38.992	38.785	37.398	35.130	35.592	34.319	34.334	34.530	18	650.801	74.300
Newcastle-on-Tyne Corporation ..	11.033	11.683	11.597	11.668	12.178	9.987	10.199	10.085	10.087	10.497	18	187.559	18.441
Nottingham Corporation	6.715	7.281	7.365	7.342	7.796	7.934	7.578	7.559	7.636	7.802	18	139.323	+ 33.025
Oldham Corporation	5.084	4.903	4.855	5.782	4.837	4.443	4.578	4.703	4.618	4.882	19	89.385	− 4.408
Preston Corporation	1.952	2.088	2.001	2.007	2.026	1.867	1.819	1.775	1.818	1.895	17½	32.299	− 2.136
Preston Motor 'Buses	...	...	...	...	...	134	132	126	128	139	17½	2.304	− -
Reading Corporation	1,696	1.735	1.674	1.646	1.914	1.574	1.556	1.533	1.575	1.533	18	28.076	− 387
Reading Motor 'Buses	377	380	380	385	484	372	392	383	397	394	18	6.470	23
Rotherham Corporation	2.021	2.135	2.199	2.400	2.602	2.100	2.076	2.047	2.131	2.122	17	36.437	+ 357
St. Helens Corporation	1.973	2.069	1.969	1.944	2.213	1.536	1.585	1.515	1.574	1.558	18	28.102	− 4.824
Salford Corporation	11.974	11.475	11.007	10.715	10.125	9.644	9.881	9.820	9.577	9.693	18⅞	188.958	16.411
Sheffield Corporation...	20.242	19.990	20,136	20.040	20.789	17.786	17,999	18.084	18.484	18.298	18⅞	335.324	24.315
Southampton Corporation	3,051	3.308	3.332	3.383	3.880	3.150	3,191	3.260	3.276	3.324	18	56.606	− 6.465
Southampton Motor 'Buses	129	92	90	91	94	106	102	105	101	100	18	1.794	− 2.469
Southend Corporation	2.959	3.403	3.765	3.995	5.239	2.958	2.958	3.029	3.377	3.514	18	48.192	+ 4.240
South Shields Corporation	1.667	1.794	1.873	1.876	2.080	1.784	1.572	1,589	1.630	1,754	18	29.821	+ 1,615
Sunderland Corporation	2.788	2.888	3.023	3.024	3.300	2.472	2.667	2.663	2.719	2.942	18	47.337	− 738
Swindon Corporation	423	372	405	416	477	358	313	317	342	388	17½	6.378	− 884
Tyneside Tramways and Tramronds	944	1.332	1.265	1.156	1.376	620	844	887	905	943	5	4.199	− 1.876
Wallasey Corporation	3,315	3.305	3.136	3.173	3,600	2.674	2,758	2.740	2.844	2,936	18½	48.737	− 4.173
Wallasey Motor 'Buses	336	370	298	325	275	226	289	239	318	275	18½	4.580	− 330
Walsall Corporation	1,680	1.707	1.681	1.737	2.002	1.436	1.453	1.446	1.383	1.408	18	28.252	− 2.497
Walsall Motor 'Buses	917	983	1.032	1.044	1.582	697	709	732	724	761	18	15.022	− 2.324
Walthamstow U.D. Council	2.528	2.474	2.283	2.254	2.539	1.816	1.864	1.820	1.938	1.935	18½	35.676	− 6.016
Warrington Corporation	1.058	966	990	995	1.058	964	905	877	893	930	18	17.172	− 330
West Ham Corporation	6.470	6.572	6.226	6.057	6.412	5.805	5.733	5.684	5.789	5.673	17⅞	103.275	− 3.621
Wolverhampton Corporation ...	2.341	2.390	2.361	2.298	2.811	1.969	2.113	2.011	2.007	2.009	18	38.210	− 3.516
Wolverhampton Motor 'Buses ...	663	644	692	661	922	606	621	608	591	613	18	11.505	− 166

Underground Electric Railways Company of London, Limited.

NAME OF COMPANY.	1921. WEEKS ENDED July 9	July 16	July 23	July 30	Aug. 6	1922. WEEKS ENDED July 8	July 15	July 22	July 29	Aug. 5	AGGREGATE. Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Underground Rlys. & L.G.O. Co. ...	253.703	244.811	240.286	241.360	242.101	229.048	231.235	231.521	241.502	232.023	31	6.993.897	− 392.736
London and Suburban Traction ...	63.692	61.703	60.307	60.279	64.031	50.416	51.855	51.837	47.057	45.531	31	1.520.426	185,318

Colonial and Foreign Tramway Traffic Returns.

Companies Issuing Weekly Returns.

NAME OF COMPANY.		1921. WEEKS ENDED July 9	July 16	July 23	July 30	Aug. 6	1922. WEEKS ENDED July 8	July 15	July 22	July 29	Aug. 5	AGGREGATE. Wks.	1922.	Increase or Decrease.
		£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine		76.128	70.740	75.967	74.366	78.025	86.010	80.931	82.108	85.627	87.331	31	2.588.463	+ 137.478
Calcutta	Rs.	96.857	97.467	96.790	91.297	96.182	115.752	115.788	117.828	11,140	111.623	31	3.229,518	+ 927.051
Madras...	Rs.	(2 weeks)	50.763	...	...	...	(2 weeks)	50.913	...	...	...	—	—	—
Pernambuco	$	2.607	2.887	3.031	3.286	3.636	2.634	3.134	3.534	3.890	4.394	31½	107,928	− 14.769

Companies issuing Monthly Statements only.

		1921. Feb.	Mar.	April	May	June	July	1922. Feb	Mar.	April	May	June	July	Wks.	AGGREGATE. 1922.	+ or −
		£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo		4,701	4.935	5,121	4.570	4 135	...	4.797	5.244	5.473	3.329	4.212	...	12	13.014	− 812
Brazilian Trac. Mlrs		11941000	13102000	13562000	14462000	14257000	...	14473000	15238000	15413000	16093000	16266000	...	26	92.515.000	+ 12316000
Brisbane		43.205	46,300	47.750	...	...	48.850	43.800	51.300	48.700	...	...	49.470	30	341.700	+ 14.555
British Columbia	$	838.682	867.083	835 793	826.039	803.903	...	821.828	849.680	818.177	827.701	802.511	...	52	10.220.054	+ 122.798
Buenos Ayres L'c'z		53.952	59.365	60.238	58.492	51.071	51.944	55.227	61.775	57.619	59.278	52.642	57.227	5	57,227	+ 5.283
Burma ...	Rs.	48,405	50,931	50,159	48.353	54.275	43,764	52.380	60.296	58.631	65.357	61.823	61,637	52	710.871	+ 106.221
Cape Town ...		...	...	27,662	27.407	25.038	...	26.980	29.930	28.657	28.006	24,658	...	—	—	—
Carthagena & H. ...		2.839	2.226	2,329	1.602	1.410	1.936	2.773	2.145	2.991	2.793	1.174	2.257	30	17.208	+ 989
Cordoba		18.600	21.717	...	...	23.129	...	21.918	25.382	...	...	26.622	...	13	77.026	+ 8.284
East India ...		3.819	4.168	4.560	4,392	4.494	4.591	3.737	4.446	4.065	3,960	3,640	3.859	52	48.541	− 2.923
Kalgoorlie... ...		316*	2.485	2,398	...	...	...	2.031	2.390	2.538	...	...	...	17	9,139	+ 1.522
La Plata		728*	3.403*	...	...	5.187	...	6.318	7,067	...	...	5.883	...	26	39.311	+ 11.420
Manila ...	$	306,389	298.317	279.534	293.873	310.559	305,126	310.001	284.576	286.044	273.218	291.434	291.093	30	2.045,639	− 69.613
Monte Video ...		48.119	48,925	46.189	46.579	42.960	42.411	48.111	51.158	47.960	48.074	44.298	48.672	39	420.463	+ 1.636
Para		20.545	22,189	22.289	22.705	22.833	22,605	21.582	22.238	23.061	23.651	23,942	23.862	35	183,962	+ 2.312
Port Elizabeth ...		...	...	7,082	6.304	6.180	...	6,690	7.851	6.892	6.713	6.412	...	—	—	—
Rangoon ...	Rs.	120,718	158,121	125,163	138.950	130.000	133.536	130.583	150.500	139.375	145.450	140.400	140.250	30	984,408	+ 55.262
Winnipeg ...	$	460,125	495,208	462,378	433,836	432.894	...	498.577	464,900	435,058	427,880	405,688	...	26	2,704,960	− 85.710

* Strike of Employees.

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Tramway and Omnibus Advertising Contractors

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LONDON	*Amberley House, Norfolk Street W.C.2*	**BIRMINGHAM**	*147 Corporation Street.*
EDINBURGH	*34 St. Andrew Square*	**LEEDS**	*Standard Assurance Buildings,*
LIVERPOOL	*64 South Castle Street*	**NEWCASTLE-on-TYNE**	*77 Westgate Road [City Square.*

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Liverpool Corporation Tramways.
Edinburgh Corporation Tramways and Omnibuses.
Belfast City Tramways.
Leeds City Tramways and Railless Cars.
Birmingham Corporation Tramways and Omnibuses.
Leicester Corporation Tramways.
Nottingham Corporation Tramways and Omnibuses.
Portsdown & Horndean Light Railway Co.
Wakefield & District Light Railway.
Calcutta Tramways Co., Ltd.
Cawnpore Electric Tramways.
Delhi Electric Tramways.
Mandalay Electric Tramways.
Newcastle-on-Tyne Corporation Tramways.
Isle of Thanet Electric Tramways Company, Ltd.
Keighley Corporation Tramways.
Keighley Corporation Railless Cars.
Burton-on-Trent Corporation Tramways.
Scarborough Electric Tramways Co., Ltd.
Aberdeen Suburban Tramways Co.
Hastings & District Electric Tramways Co., Ltd.
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Gloucester Corporation Light Railways.
Ilkeston Corporation Tramways.
Stockport Corporation Tramways.
Ilford Council Tramways.
Bradford Corporation Tramways.
Halifax Corporation Tramways.
Perth Corporation Tramways.
Malta Tramways Company.
Coventry Corporation Tramways.
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Maidstone Corporation Tramways.
Yorkshire (West Riding) Electric Tramways Co., Ltd.
Croydon Corporation Tramways.
Dundee Corporation Tramways and Omnibuses.
Stockton and Thornaby Corporation Tramways.
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ON ANY SYSTEM OF TRAMWAYS OR OMNIBUSES

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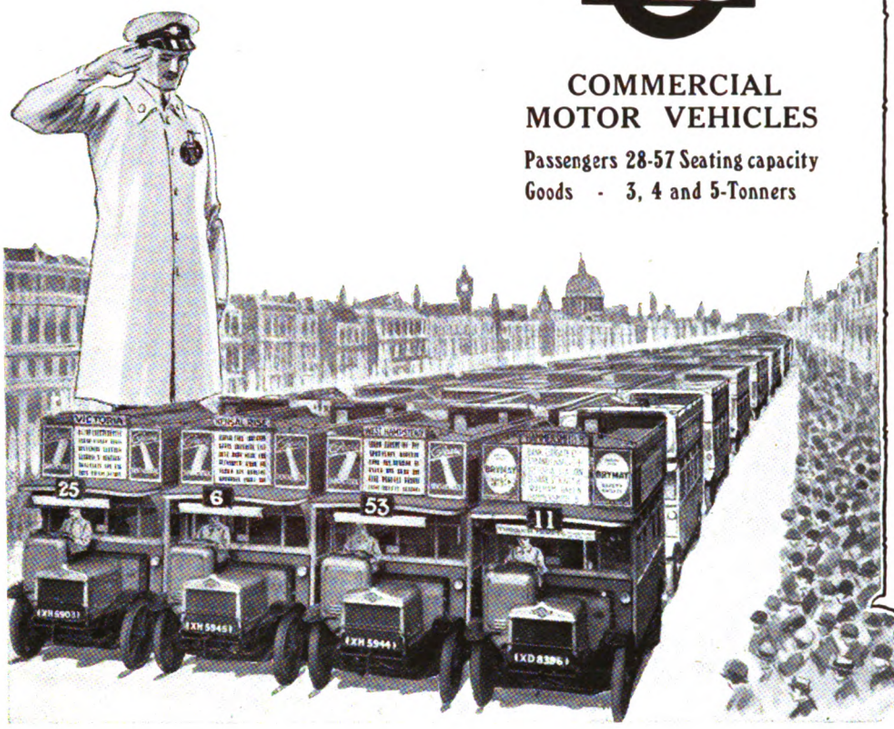
London's Traffic Giant reviews his fleet



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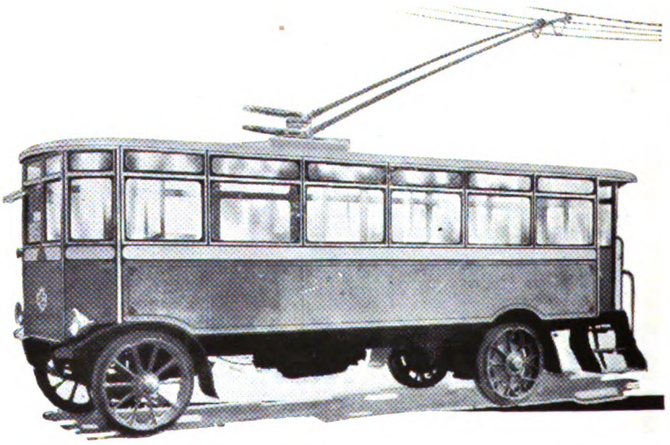

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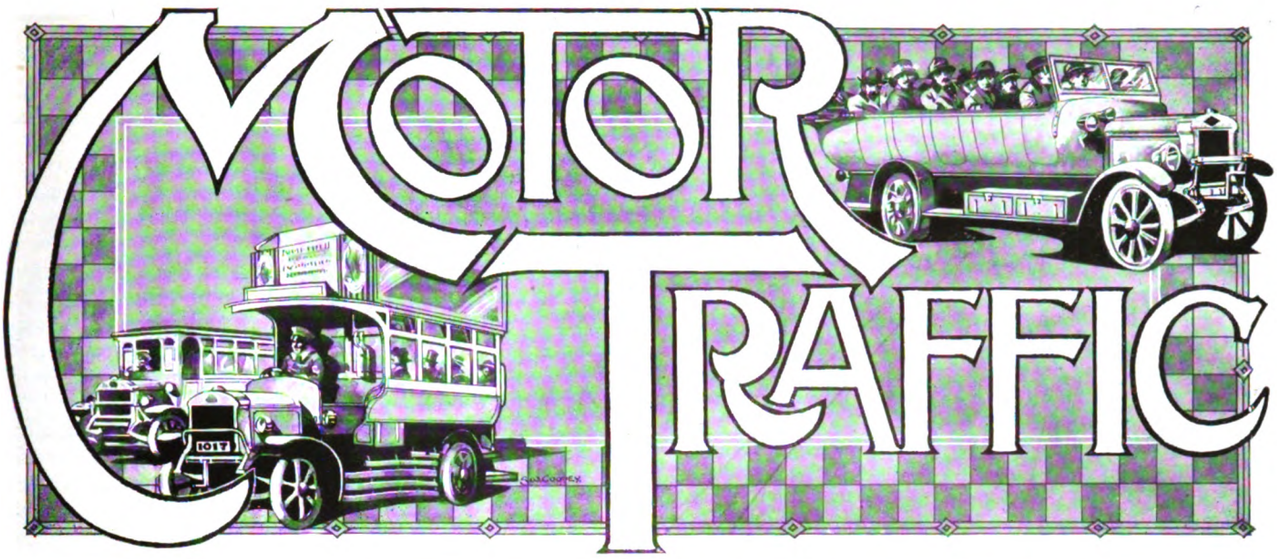

MOTOR TRAFFIC SECTION—SEVENTEENTH YEAR OF PUBLICATION.

LIGHT CHASSIS FOR PUBLIC SERVICES.

The increasing popularity of the 30-cwt. and 50-cwt. chassis for both goods and passenger carrying in the public service field is easily traceable to two outstanding factors, namely, low cost of operation and wide sphere of usefulness. For the movement of heavy material such as is required for road construction, building operations, and kindred services, as well as for coal and refuse carting, 4, 5 and 6-ton machines are a necessity, while the 3 to 4-ton passenger chassis, which has become the standard of the leading manufacturers for omnibus work, continues to give excellent results. In practice, however, it has been found that there are many services which motor vehicles should cover, but owing to the heavy costs of running the larger type machines it is inexpedient to use them except for the purpose for which they are designed. For some time past railway companies have been using a large number of machines with carrying capacity of 30 cwt. for the collection and delivery of parcels, while the 50-cwt. delivery van has a well-defined sphere in the goods department of each of the railways. The fact that the number of these are being added to almost continuously is perhaps the best possible proof of their efficient service, and as in every case the officials responsible for their operation have a wide experience with the heavier type machines, it is clear that those best qualified to judge are convinced that for real economy a close division of the transportation services, with vehicles specially adapted for each, is essential. As with the railway companies so with all public authorities. Owing to the heavy railway rates many Corporations have found it an economy to use their own vehicles to draw coal and heavy road and building materials from docks and depots. These authorities employ a large number of machines for that work, but for purposes requiring speed for light loads the small machine is necessary. There are a number of thoroughly reliable types of light vehicles now on the market.

FOR PASSENGER TRANSIT.

Another important development in the use of the light motor chassis is in connection with the one-man omnibus. Many new routes are capable of development with a small, economically operated vehicle, run at intervals regulated by the demand, which would be impossible if attempted with the omnibus of large seating capacity, such as are necessary to maintain the services on the main routes in the big centres of population. Moreover, even on these established routes there are times of the day when it is not profitable to run the big vehicles, and at such periods an efficient service could be maintained by the use of small conveyances with a consequent higher percentage of occupied seats and a greater degree of financial success. Another consideration is the reduced wear of the roads, an all-important factor in these days of high charges for road maintenance. Public authorities are clamouring for increased grants from the Road Fund, and are laying on heavy vehicles the blame for the expense entailed in making good the rapid deterioration of road surfaces. As a matter of fact, it would appear to be due more to the use of unsuitable materials, combined with the high charges for supply, freight, and labour. Leaving this digression, it is evident that public services of one kind or another must continue. With operating costs practically stationary, it is essential that the highest degree of efficiency should be obtained from motor transport. This can be achieved only by exercising the greatest care in the selection of vehicles best suited to the class of work in which they are to be employed.

LIGHT VANS FOR SMALL TRADERS.

While the British commercial vehicle industry has shown itself capable of producing vehicles of the highest quality obtainable anywhere, and exceptionally satisfactory as regards durability and reliability, it has been charged with laying itself open to the criticism that it has paid too little attention to the production of the lightest vans for express delivery purposes. Such vehicles, to secure a large market, must be available at comparatively low prices, since they appeal very largely to comparatively small traders to whom the strict limitation of the original capital investment is of the first importance. Critics of the British industry must, however, remember that the problem is a very complex one. It is only possible

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to produce a chassis of the type required at a very low price if the demand for it is very substantial and dependable. Possibly the ultimate solution will be found in the production of popular car chassis, with preconceived standardised modifications to render these absolutely suitable for light commercial work.

THIS YEAR'S SHOWS.

At present there is no certain information as to whether the extension of Olympia now under construction will be completed in time for it to be utilised for the motor show which opens on November 3. The doubt is unfortunate, inasmuch as firms have been necessarily required to make application for space without any certainty as to whether the area allotted to them will be in the Olympia building or, as may happen if the extension is not completed, at the White City. Presumably the extension will be available, if required, for the cycle and motor cycle show, which does not open until November 22. In some quarters there is a feeling of regret that there is to be no Commercial Vehicle Exhibition this autumn. At the time the decision was taken it was fairly generally agreed that, under the existing trade conditions, the expenditure could not be justified by any probable direct results. The trade and users have, however, come to look upon the Commercial Vehicle Show as an annual affair, and it remains questionable whether any indication that it may become an irregular event is not to some extent detrimental to the industry as a whole. It is certainly important that the industry should not allow it to be supposed that the British commercial vehicle industry is falling into the background and giving way to its foreign competitors. Such is not the case, but in so far as the absence of a show may tend to create this impression, the decision, though justifiable on immediate economic grounds, may perhaps be somewhat regrettable. As regards the more distant future, it seems obvious that either the Commercial Vehicle Show must be a regular function or else the manufacturers in that industry must be given considerable freedom to exhibit in other quarters should they desire to do so. Presumably a show will be held in the autumn of 1923, when the Public Works Exhibition is also booked to take place. Some persons therefore might be inclined to suggest that if the show confined entirely to commercial and public service motor vehicles is not to be held every year, it might be found well to alternate it with this other exhibition, which appeals so directly to municipal officials, and to take the necessary steps to ensure that motor manufacturers desirous of cultivating municipal business shall not be impeded from doing so by any regulations of their own making. The policy of limiting shows is undoubtedly a sound one, and deserving of general support, but it is equally obviously one which might conceivably be carried to undesirable extremes.

PARAFFIN CARBURETTERS.

Either by accident or by design the policy of the big suppliers of petrol has certainly been such as to discourage inventors and manufacturers from devoting their time to the development of paraffin carburetters. Periodical rises in the price of petrol incite the motoring community to study the possibilities of creating and of using other fuel supplies, but it almost invariably happens that, directly signs of progress in the desired direction become at all obvious, the price of petrol drops to such a point that further investigation seems for the moment to be hardly worth while. Consequently the motor user, seeing little possible immediate saving, hesitates to employ other fuels or fuel-burning devices which represent only a trifling saving, and may possibly give him a certain amount of trouble. Nevertheless, in certain quarters quiet progress has been made in the evolution of apparatus for burning paraffin, and, provided their outlook is wide enough, motor users may certainly congratulate themselves that this is the case. Admittedly paraffin supplies are drawn from the same sources as petrol supplies, so that prices are always subject to manipulation. On the other hand, the ordinary laws of supply and demand tend to make paraffin distinctly cheaper than petrol, and these laws cannot be permanently ignored. For some time past paraffin has been extensively used in marine motors and in the engines of farm tractors. In these two cases the problem is comparatively a simple one, seeing that the engine is required to work almost invariably at a steady speed and with an unvarying throttle. It is in the case of the road vehicle, where the load varies constantly and over a wide range, that the problem is a difficult one, particularly in temperate and cold countries, and up to the present, as regards road vehicles, the use of paraffin has been regarded as thoroughly practical only in tropical countries. However, as already mentioned, distinct progress is being made by certain inventors whose work should, in the fairly near future, have a very appreciable effect on the world position as regards motor fuels.

PROFITABLE OMNIBUSES.

BIRMINGHAM AND EDINBURGH RESULTS

At a July meeting of Birmingham Corporation, Councillor F. Smith, chairman of the Tramways Committee, agreed to a suggestion by Councillor Kenrich that the committee should submit a report on the estimated expenditure on renewals of motor omnibuses during the present financial year and the estimated revenue, also recommendations as to the fares to be charged from October 1 next. Councillor Kenrich said the accounts for the past year showed £15,000 had been carried to profit and loss account. He understood the whole of the capital expenditure had been written off, and therefore the £15,000 should be used for the reduction of fares on similar lines to those agreed upon in the case of the tramways.

Mr. R. Stuart Pilcher, general manager of Edinburgh Corporation Tramways, in his annual report on the department, gives the revenue of the motor omnibus section as £183,739, as compared with £93,000, an increase of £90,739. The passengers carried totalled 20,407,736, as against 10,158,810, an increase of 10,248,926. The working expenses were £140,748, interest and sinking fund £21,828, and the surplus £21,163. The amount in reserve as at May 15, 1921, was £13,912; this, added to the surplus from this year's working, makes a total of £35,075 in reserve. The revenue from coach pleasure tours for the year was £9,647.

Experiments have been conducted with super-cushion tyres, as a result of which they have been adopted on all passenger vehicles. A trial is now being made with pneumatic tyres, and also with concrete tracks, with a view to the reduction of vibration.

The Council, at their July meeting, adopted a recommendation of the Tramways Committee to purchase two double-deck omnibuses from the Associated Equipment Company, Walthamstow, at £1,500 each. Mr. Mancor (convenor of the committee) said they had found from experimental running that these double-deck omnibuses were very popular. This was purely a summer omnibus, and it could make enough money in the summer to justify its use.

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MOTOR TRAFFIC

THE BRITISH MOTOR TRADE.

SIR JOHN THORNYCROFT ON THE NEED FOR PROTECTION.

Sir John Thornycroft, managing director of John I. Thornycroft and Company, Limited, writes—

The manufacture of motor vehicles, which is the youngest but not the least important branch of the industry in this country, seemed, before the war, to have passed through its initial difficulties and to give every prospect of becoming one of the most important in the country. It had been built up with great difficulty and without the assistance of any tariff. A really good export business had been commenced in our colonies and dominions and in other overseas markets as well. During the war these markets could not be supplied, and American manufacturers, who had done next to nothing in the way of supplying commercial vehicles, seized the opportunity to make the most of them. Not only the American manufacturers but the Italians, who somehow managed to make vehicles for export during the war, also took advantage of the British makers' inability to supply. When British makers were able to manufacture again for export they found their overseas markets had been captured and that there were such large stocks of vehicles already there that very little business could be done, and many of the firms who took the risk of sending out vehicles in the hope of sales have them still on their hands.

On the conclusion of peace there was for some time a good demand for vehicles in this country, but foreign makers immediately started to compete. A 33⅓ per cent. duty was placed on pleasure cars, but, for some reason, politicians decided that commercial vehicles should come into the country duty free. Large numbers of American make, having been produced in a country which had the foresight to protect its own home market and enable manufacturers to produce in enormous numbers, were shipped here at prices with which British makers could not compete, largely due to their being only able to manufacture in much smaller numbers. The Continental manufacturers, with depreciated exchanges, have continued to supply vehicles of all sorts at prices which would not pay for the material alone here. Barge loads of Italian vehicles can be seen passing up the Thames daily and new German vehicles are at work in the London streets. Recently a large advertisement was to be seen in one of the daily papers calling attention to the reductions in prices of one of the leading British makes. On the same page there appeared an advertisement calling attention to the possibility of taking immediate delivery in this country of new vehicles of the same capacity, "of excellent design and workmanship," of German make at one-third the price of the British lorry.

Some politicians say that when we buy manufactured articles from abroad it is for the good of the country to get them cheaply, and, in any case, it is the only way the German war idemnity can be paid—to take goods from them. But while this is going on British mechanics cannot find employment, and those who have invested savings in factories specially put down to make motor vehicles, get no dividends and lose their money.

With the exception of some few of the companies who have catered for the demand for a small car, it is doubtful if there are any in the country who are not working at a loss. The balance sheets of some of the leading companies recently published show the extent of the losses.

If the Government and the members of Parliament who profess to be doing their best to relieve unemployment will not take any steps to help protect the British manufacturing motor industry, which is quite distinct from that of the middleman and importer, and surely more important to the country, will not mechanics in want of employment and the shareholders who have invested their money take some joint action to impress on the Government the advisability of putting a stop to the free importation into our home markets ?

The extent to which the overseas markets can be recovered is very uncertain in view of the tendency to try and develop home industries in many of them by import duties, amounting to as much as 40 per cent. on spare parts in Australia.

The protected American market is now booming, and vehicles are being manufactured there in such enormous numbers that they can be offered for sale abroad at prices with which British vehicle manufacturers cannot compete. This makes it more than ever necessary to preserve our home markets for British manufacturers.

BOLTON CORPORATION have abandoned their proposals to secure power to run omnibus services beyond the boundaries of the borough.

A RECORD MOTOR OMNIBUS LOAD.

Leyland Motors, Limited, have sent us a photograph of a motor omnibus loaded with 121 passengers, a number which probably constitutes a record for passenger service of a single machine of the 4-ton type. It appears almost incredible that so large a number of

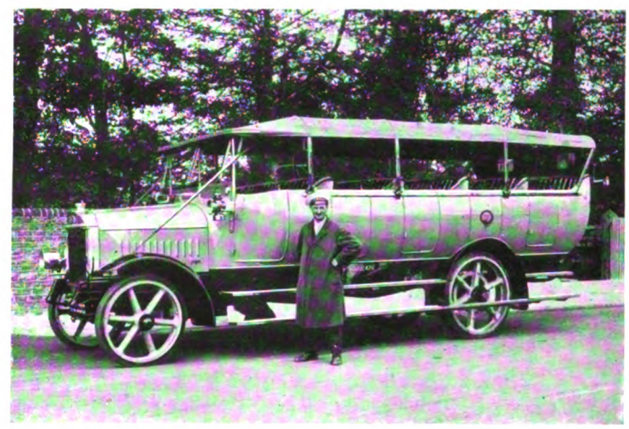
A Well-Loaded Leyland.

people could be carried on one trip, but the statement is confirmed by various witnesses. The machine is a Leyland subsidy 4-ton type, and is run by Messrs. Wyartt Brothers, between Ipswich, Bildeston, and Bury St. Edmunds. The machine has been used on this service since July, 1919, and the owners say that nothing has been done to the engine except grinding in the valves.

Mr. T. H. Wyartt says he is well satisfied with the machine and mentions that he has just had a rail put round the top deck—which, of course, would be more satisfactory for a machine with such a large seating capacity.

A DENNIS BULBOUS-SIDED COACH.

The illustration below represents a good example of a Dennis 18-20 seater "bulbous-sided" motor coach. The firm of S. Tanner, of Cobham, has recently taken delivery of this vehicle, which is



Dennis 18-20 Seater Coach.

finished in pearl grey, and to prevent scratching, the back panels of the seats are covered with grey carpet to match, while the upholstery is in black leather. Fitted with Dunlop super-resilient cushion tyres, this machine is an excellent example of luxurious motor coach design and manufacture.

ILFRACOMBE URBAN COUNCIL have refused an application by the Hardy Garage Company for licences for omnibuses to run between Ilfracombe and Minehead, considering, in view of the narrowness of the roads, there are already enough motor vehicles in Ilfracombe.

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POPULARITY OF DENNIS SINGLE DECKERS.

Mounted on a chassis giving maximum comfort by means of a sufficiently long wheelbase and width of track, and adequate springing, the latest type of Dennis single-deck omnibus maintains the reputation of the Guildford Works by securing increasing popularity amongst operators and their patrons. This statement is substantiated by the experience of numerous undertakings, of which one in particular may be cited. The machine illustrated on this page was recently supplied to the Greyhound Motors, Limited, who thereby bring up their fleet of Dennis omnibuses to twenty.

Other features of the Dennis single-deck vehicle may be cited besides those already mentioned. First, the prices are reduced to pre-war level. With the type of front entrance body shown the vehicle can be operated by one man, although it has seats for as many as 33 passengers. The seating is comfortable, and the body is so constructed that the occupants can be given the enjoyment of open-air travelling. This facility is effected by means of Strachan and Brown's patent adjustable windows, which have the advantage of being free from rattling. A low combination of steps and conveniently shaped grab handles ensure easy entrance and exit. Being well protected from the weather, the driver-conductor can perform his duties in comfort.

Little need be added of the merits of the Dennis chassis. The engine develops 40 to 50 H.P. from four cylinders cast in pairs. There is quietness of operation while accessibility is a characteristic. Adequate engine power admits of acceleration to attain a speed of 20 miles per hour, and the vehicle will climb a gradient of 1 in 6 when fully loaded, the fourth speed providing a direct drive. Accessibility is apparent at all other necessary points outside the engine. For instance, the top cover of the steel casing which carries the weight of the back axle is easily removable without taking down the axle or the wheels. When removed it carries with it the worm gearing and wheel and the differential gear. The live axles themselves can be easily withdrawn without removing the wheels or jacking up the chassis. Engine clutch and gear box are carried

A Dennis Single Decker.

upon an underframe suspended at three points, thus ensuring flexibility and preventing any lack of alignment. Protection to the working parts from mud and dust is afforded by an under-shield of non-rusting sheet steel, extending from the engine to the back of the gear box.

ALCOHOL FUEL FOR MOTORS.—An announcement of interest to motor users was made at the annual meeting of the Distillers' Company at Edinburgh on July 14 by Mr. W. H. Ross, the managing director. He stated that with the valuable aid of the Fuel Research Board and the Board of Customs the company had been able to erect a mixing and denaturing plant for producing their new alcohol fuel known as "Discol," which was being regularly supplied to a limited number of users. He had employed it in his own car for three months with eminently satisfactory results. The directors were so convinced of the future of this product that they had just completed the installation of a second plant in Liverpool, and were preparing plans for a third installation in Glasgow. The price of the new fuel is 1s. 9d. per gallon. It is composed of alcohol, power methylated spirit, and a vegetable which is stated to come from India and Ceylon.

MOBILE WATER STERILISER.

NEW USE FOR A.E.C. CHASSIS.

A useful type of mobile water sterilising plant, fitted to an A.E.C. standard 4-ton chassis, has been designed by the Associated Equipment Company, of Walthamstow. The rear springs of the chassis have been strengthened and the frame reinforced by a tie-bar to carry the heavy concentrated loads of a filter and water tank. The plant consists of a Lister auxiliary engine driving a rotary pump,

Motor Water Sterilizer on A.E.C. Chassis.

filters to remove foreign matter from the water, and a chemical apparatus which ensures the filtered water being quite sterile. Different sections of pipe are painted in distinctive colours to simplify the operation of the plant. These colours indicate that the water passing through any section is either dirty, filtered, or quite pure.

The plant, which is shown in the accompanying illustration, must be capable of producing 800 gallons of pure water per hour from any source before H.M. War Department will pass the vehicle. At the rear of the body is a small compartment fitted up as a laboratory where the chemist who accompanies each vehicle when on active service can carry out chemical and bacteriological tests. As part of the apparatus is rather valuable, the vehicle is never left unattended when on service. The driver's cab therefore has been equipped as a sleeping berth. The front and sides can be closed by means of curtains, and a folding bunk has been fitted above the driver's head. This can be dropped when required, the second occupant using what is normally the driver's seat.

THORNYCROFT PRODUCER-GAS VEHICLE.

Messrs John I. Thornycroft, Limited, have entered a producer-gas vehicle for the trials being conducted by the French War Department with a view to determining whether such a power plant can be utilised with advantage in lieu of petrol. Messrs. Thornycroft have mounted their suction gas producer on one of their 3-ton "J" type lorries, and it is found that the process of starting the production of gas takes from five to ten minutes. A series of tests made with anthracite and charcoal gave the following results—

	Anthracite.	Charcoal.
Calorific value, B.Th.U. per lb.	14,700	13,200
Distance in miles	28	28
Time (non-stop run)	2 h. 20 min.	2 h. 5 min.
Speed, miles per hour ...	12	13·4
Moisture content, per cent. ...	1·8	·7
Fuel consumed, in lb.	70·5	109·2
Fuel in lb. per mile	2·51	3·9
B.Th.U. per mile	36,897	38,280
Gross ton-miles per lb. ...	2·97	2·73
Weight of water used, lb. ...	45	35
Weight of vehicle	7 t. 10 c. 2 q.	7 t. 9 c. 2 q.

LONDON OMNIBUS MEN'S WAGES.—In accordance with the sliding scale agreement the wages of London omnibus workers have been reduced, drivers 2s. and conductors 1s. 6d.

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MOTOR VEHICLES FOR MUNICIPALITIES.

AMERSHAM RURAL COUNCIL have decided to purchase a motor lorry.

WARRINGTON CORPORATION have purchased a Fiat 10-15 H.P. motor car.

MERTON AND MORDEN URBAN COUNCIL have decided to purchase a motor ambulance.

CARDIFF TRAMWAYS COMMITTEE are to invite tenders for the supply of motor omnibuses.

KENDAL HIGHWAYS COMMITTEE recommend the purchase of a 2-ton Vulcan lorry at £735.

LEWISHAM BOROUGH COUNCIL propose to purchase a 3½-ton Thornycroft lorry at £1,064.

ILKLEY URBAN COUNCIL are raising a loan of £1,800 for the purchase of a motor fire engine.

HALIFAX CLEANSING COMMITTEE report the purchase of a Laffly motor sweeper at a cost of £975.

WALTHAMSTOW ELECTRICITY COMMITTEE have purchased a second-hand Calthorpe coupé car.

NEWCASTLE CITY COUNCIL propose to purchase four electric, four petrol, and three steam vehicles.

HULL CITY COUNCIL have received sanction to borrow £1,718 for the purchase of a motor fire engine.

KENT COUNTY COUNCIL have authorised the purchase of a motor car for the Faversham Police Division.

POPLAR WORKS COMMITTEE have recommended the purchase of a Laffly motor sweeping machine at £975.

EAST HAM CORPORATION are purchasing a vehicle at a cost not exceeding £850 to replace an old Austin car.

WEST BROMWICH TRAMWAY COMMITTEE have recommended the purchase of a second-hand 5-ton steam wagon.

SOUTHWARK WORKS COMMITTEE recommend the purchase of two Lacre motor sweepers at £652 2s. 6d. each.

BRADFORD FIRE BRIGADE COMMITTEE have sold a 1914 Dennis motor pump to Messrs. Joseph Dawson for £400.

TODMORDEN CORPORATION MOTOR OMNIBUS SERVICES for the year ended March 31 last show a surplus of £2,060.

MIDDLESEX COUNTY HEALTH COMMITTEE recommend the purchase of a Sunbeam car for the medical officer at £450.

LANCASHIRE COUNTY HIGHWAYS COMMITTEE suggest the purchase of a car at a cost of £365 for the use of the surveyors.

BEXLEY URBAN COUNCIL have invited quotations for a motor vehicle to carry 12 firemen, and equipped with a pump.

ROTHERHAM CORPORATION have authorised the purchase of four more one-man omnibuses from the Guy Motor Company.

ST. HELENS COUNCIL have fixed the charges to the various departments for the hire of a car at 1s. per mile or 10s. per hour.

LICHFIELD CITY COUNCIL have arranged terms with Lichfield Rural Council for the joint purchase of a motor fire engine.

BUCKIE COUNCIL'S sanitary inspector, in his annual report, again suggests the adoption of motor traction for refuse collection.

ROCHDALE CLEANSING COMMITTEE have purchased a 3-ton Leyland chassis fitted with a special body and hydraulic tipping gear.

OSSETT TOWN COUNCIL have appointed a sub-committee to report as to the provision of motor transport for the highways department.

WALLASEY CLEANSING COMMITTEE have placed an order with Electricars, Limited, for an electric vehicle, at £1,482 10s., for refuse collection.

HERTFORDSHIRE COUNTY COUNCIL, on the recommendation of their Highways Committee, propose to purchase six Foden steam wagons at £6,200.

SYDNEY (N.S.W.) COUNCIL have adopted a recommendation of their Works Committee to purchase a Karrier sweeping machine at a cost of £2,600.

CAMBERWELL WORKS COMMITTEE recommend the purchase of a 5-ton Sentinel end tipping steam wagon, with detachable 850 gallon water tank, at a cost of £1 150.

BLACKPOOL ELECTRICITY COMMITTEE have decided to purchase a motor car and a 20 cwt. chassis. The Corporation propose to obtain a motor ambulance and a disinfecting van.

THE METROPOLITAN ASYLUMS BOARD are replacing solid tyre omnibuses with pneumatic tyred vehicles. The displaced chassis are to be fitted with lorry bodies for general transport work.

GLASGOW MAGISTRATES' COMMITTEE recommend court proceedings to settle a point in regard to the motor licence duty payable on vehicles used by the Education Committee for the conveyance of crippled children.

THE AMBULANCE COMMITTEE of the Metropolitan Asylums Board recommend acceptance of the tender of Clement Talbot, Limited, for the supply of 15 chassis at £590 each, the price including all accessories but not bodies.

WEST BROMWICH HIGHWAYS COMMITTEE recommend the purchase of a motor street gully emptier at a cost of £1,000. The Tramways Committee have advised the purchase of a second-hand steam wagon at a cost not exceeding £500.

LANCASTER ECONOMY COMMITTEE have reported that the surveyor is rearranging the work of refuse collection, and that by the provision of additional motor transport he estimates a saving exceeding £3,000 per annum can be made.

WIMBLEDON CORPORATION contemplate the purchase of a road sweeping machine. International Motors, Limited, have notified that they have a vehicle which they would be glad to submit for inspection, and the Corporation have referred the matter to committee.

ROTHERHAM TOWN COUNCIL have decided to establish a central garage for all motor cars and motor vehicles used by the departments. The garage will be controlled by a Transport Committee, and the general manager of the tramways (Mr. T. P. Sykes) will be in charge.

BIRMINGHAM WATCH COMMITTEE have recommended the Corporation to purchase a motor turntable fire escape at an estimated cost of £3,000, but the Finance Committee have advised that in view of the existing financial conditions the expenditure should not be incurred for the present.

A MANSFIELD CORPORATION report shows the average cost of refuse collection for the three months ended March 31 to have been according to distance 6s. 4d. per ton by electrics and 6s. 7d. by horses and carts; 7s. by electrics and 8s. 8½d. by horses and carts; and 9s. 5d. by electrics and 11s. 4d. by horses and carts.

OMNIBUS SERVICES.

OWNERS TO BE SUMMONED FOR SPEED OFFENCES.—The police superintendent at Aldershot informed the justices, when a driver was fined £2 2s. for driving a coach six miles per hour in excess of the legal limit of 12 miles, that drivers were allowed five hours for a journey of between 70 and 80 miles, and to comply with their orders were compelled to break the law governing motor coach speeds. In future he intended to prosecute owners as well as drivers.

BRISTOL.—By the issue of licences to the Greyhound Omnibus Company competition with the omnibuses of the Bristol Tramways Company has been introduced in the district. One result is that increased smoking accommodation is being provided for smokers in the tramway company's omnibuses.

CALCUTTA.—In August last the tramways company placed several omnibuses in service. According to the chairman's remarks at the company's annual meeting, the results so far have been disappointing. The directors are of opinion, however, that a use of these vehicles can best be found for special traffic purposes pending the further development of the city, which is now proceeding under the capable management of the Calcutta Improvement Trust.

MANCHESTER.—After inspection and approval of the routes by a sub-committee, the Tramways Committee have recommended that trials be made with one-man single-deck omnibuses for light services, including two new routes which are to be opened up. One is from Palatine Road to Reddish; the other being from Marsland Road (Sale) to Washway Road, in extension of the present Palatine-Sale service.

WAKEFIELD.—Approval has been given by Shelley Urban Council to a service of omnibuses to that town from Wakefield by the Yorkshire (West Riding) Electric Tramways Company. The extensive fleet of the company is being increased by a number of 32-passenger omnibuses with 40-H.P. engines, supplied by the Bristol Tramways and Carriage Company at £1,050 for chassis and £1,650 for chassis and single deck body.

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MOTOR TRAFFIC NOTES.

WATER TANKS FOR STEAM WAGONS.—Bolton Corporation have withdrawn from their Parliamentary Bill a clause enabling them to place water tanks, for use by users of road locomotives, under any street outside the borough.

RESPONSIBILITY FOR PASSENGERS' CONDUCT.—Under the new by-laws of the county of Essex, the Brentwood magistrates on July 15 fined the driver of a motor coach a nominal sum for permitting women passengers to commit breaches of the law. A passenger was fined 20s.

COACH TRAFFIC DEPRESSION.—Up to the end of July coach traffic from London to the coast and long distance touring had considerably fallen off as compared with last summer. The depression is attributed to the unsettled weather. Half-day and evening trips had maintained their popularity.

CLOSING OF ROADS AT BEVERLEY.—The Minister of Transport has decided to make an Order prohibiting the use of certain roads in Beverley by heavy motor traffic. The order will prohibit the use of several roads for five years to all heavy motor vehicles except those being used for the conveyance of goods to or from houses on the road.

NUMBER OF MOTOR VEHICLE LICENCES.—The Ministry of Transport state that the approximate number of motor licences on May 31, 1922, totalled 883,921, and the amount received in payment for such licences from December 1, 1921, to May 31, 1922, was £9,215,061. Horse-drawn vehicles licensed numbered 214,465, and the receipts were £167,513.

COACH TRAFFIC AT PORTSMOUTH.—The Watch Committee are framing regulations dealing with the construction of motor coaches, their routes, stopping places, and fares. The regulations will be submitted to the proprietors for approval and suggestions before final adoption. As there are only two main thoroughfares in the town, which converge at Hilsea into the one road out, the police have a difficult task to regulate the traffic.

DISPOSAL OF GOVERNMENT VEHICLES.—The agreement between the Surplus Government Property Disposal Board and the Slough Trading Company, Limited, relative to the disposal of surplus mechanical transport vehicles, spare parts, arisings, etc., terminated on April 6, and future transactions will be conducted direct by the Disposal and Liquidation Commission. At certain depots abroad directions have been, or may be, issued to Government representatives to arrange for the local sale of vehicles.

DAMAGES FOR ACCIDENT DUE TO UNROLLED METAL.—The Durham County Court judge, on July 17, awarded a motor cyclist £75 as damages for being thrown off his machine and injured while riding to Houghton-le-Spring late at night. The defendants were Chester-le-Street Rural Council, and it was alleged that the mishap was due to metal being placed on the road and left unrolled. This was denied, and the Council asserted that every care was taken to prevent a recurrence of an accident that had previously occurred at the same place.

COMPLAINT AGAINST LORRY DRIVERS.—The chief constable of Stoke-on-Trent has informed the Watch Committee that he might have to ask for the provision of a motor side-car for the purpose of overhauling reckless drivers on Trentham Road. The principal offenders were the drivers of heavy motor lorries hurrying home from the north to Birmingham and to places in Shropshire. They cut in between other vehicles, and took up more of the road than they were entitled to, and also considered that they were entitled to drive as fast as they liked.

THE PROVERBIAL "BUSMAN'S HOLIDAY."—The accompanying photograph was taken on the occasion of the second annual outing of the Lincoln Corporation tramways and motorbus employees, who, with their friends, were carried to Cleethorpes and back, a round journey of over 100 miles, in the 11 "Dennis" single-deckers which constitute the Corporation's fleet of omnibuses. "These 'buses," Mr. R. Hoggard, the general manager reports, "have not lost seven journeys on the whole of the roads in twelve months."

TESTS FOR DRIVERS.—In the House of Commons, Mr. Neal, Parliamentary Secretary of the Ministry of Transport, stated that the Minister of Transport had no power to require special tests for drivers of chars-a-bancs. The questions requiring tests in the case of vehicles licensed to ply for hire were being considered by the Departmental Committee on the licensing and regulation of hackney vehicles. Drivers of hackney carriages underwent certain tests in the Metropolis and some other places, but the law and practice varied very much in different parts of the country.

Lincoln Corporation's Fleet of Motor Omnibuses with Dennis Chassis.

COACH WHEELS ADRIFT.—During July two instances were reported of a wheel coming off motor coaches. In one case the vehicle was crossing Westminster Bridge, when a wheel became detached, bounded across the road, struck the kerb, and leaped the parapet into the Thames. It was recovered by boatmen opposite Charing Cross railway bridge, and was refitted to the coach which resumed its journey to Bournemouth after an hour's delay. The other mishap happened at Grimsby, the wheel knocking down two cyclists, who sustained injuries, while their machines were smashed.

RURAL COUNCILS AND OMNIBUS SERVICES.—At the annual conference of the Rural District Councils Association a resolution was adopted requesting the Executive Council to consider the practical difficulties of rural district councils in regard to the running of regular motor omnibus and coach services, and to take steps to have official machinery devised to enable councils to take action whenever nuisances arose in connection with these vehicles. In view of the alarming increase in the cost of road maintenance, it was decided that representations be made to the Ministry of Transport as to the necessity of further grants-in-aid being made to rural councils.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, SEPTEMBER 14, 1922. VOL. LII.

NEWCASTLE CORPORATION TRAMWAYS.

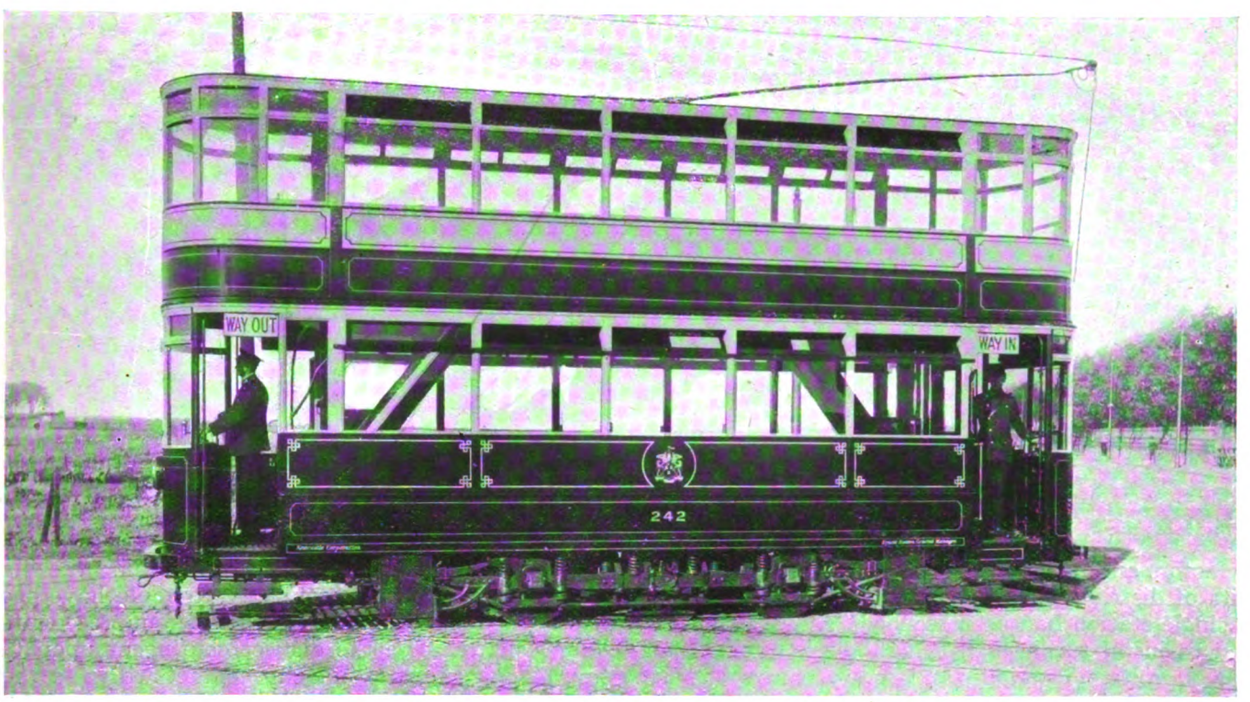
An Important Municipal Undertaking Which This Year Reaches Its Majority

Newcastle, where the annual meeting of the Municipal Tramways Association is being held this month, has one of the most important tramway undertakings in the country. In fact there are only a few tramway systems in the country which have a greater length of track. The Corporation now own 76 miles of single track, and in addition they possess running powers over 6⅛ miles of the lines of the Tyneside Tramways and Tramroads Company. Recent Parliamentary Bills and Light Railway Orders authorise the construction of a further 17½ miles of track, and when the whole of these extensions are completed the city will have a total length of 93½ miles of single track.

A feature of the present extension of great public utility is the linking up of the Corporation's system with that of the Gateshead and District Tramways Company by a double line, to be laid over the High Level Bridge which spans the River Tyne. This bridge, which was designed by Robert Stephenson, was completed in 1849; and on its upper deck the main line of the North Eastern Railway is carried over the river, 112 ft. above high water mark. On the lower deck of the bridge, which is hung from the main girders, runs the main road north and south, and it is on this lower deck, which is at present undergoing reconstruction, that the tramway tracks are being laid. The total length of the bridge, including approaches, is approximately a quarter of a mile.

The city was among the first to municipalise and electrically equip its tramways, the first electric line being opened in November, 1901. The original rails were 101 lbs. per yard, but latterly a heavier section has been adopted, viz., B.S.S. No. 5, weighing 110 lb. per yard, while B.S.S. No. 5C, weighing 116 lb. per yard, is used at junctions and curves. All rails are now manufactured under the Sandberg silicon process. A welding plant, to which reference is made below, has been adopted for welding joints and building up work on the crossings and junctions.

Side poles are generally used throughout the system



Car with Inside Staircases and Front Exits—Newcastle Corporation Tramways.

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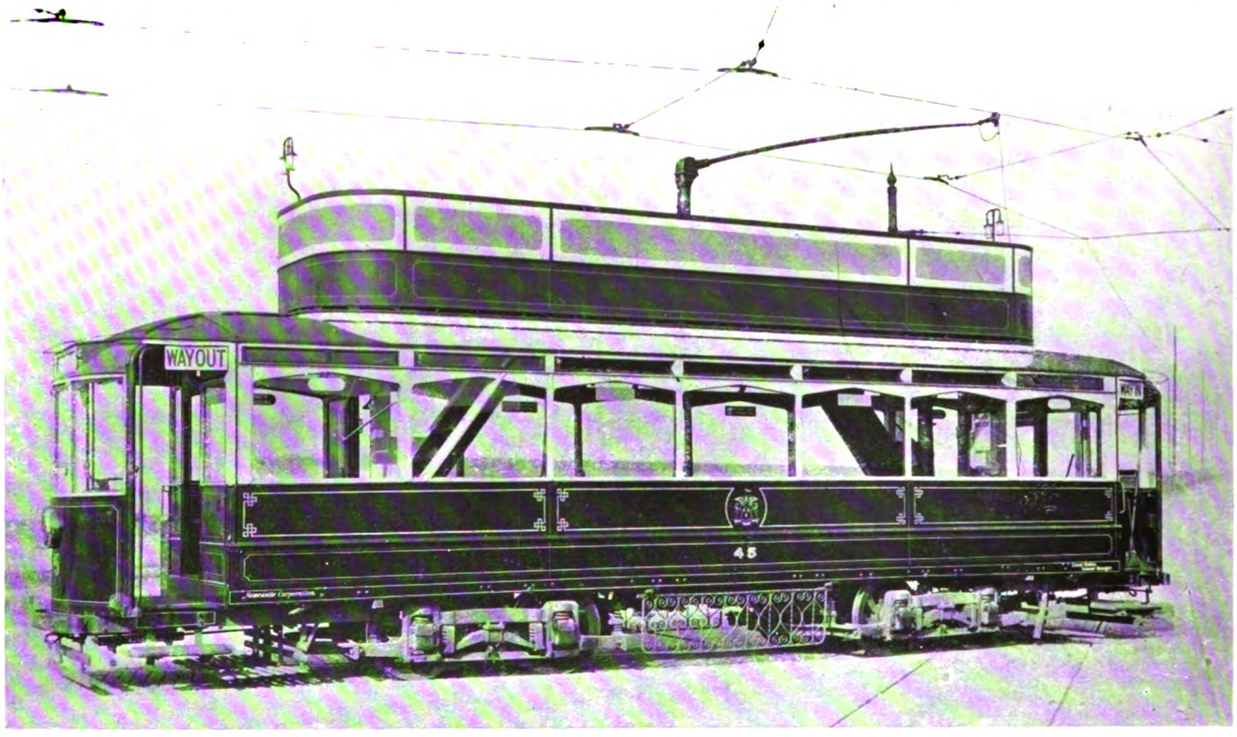
for carrying the overhead construction, and copper trolley wire 0000 S.W.G. of the grooved pattern, with mechanical ears, is employed. Many of the original centre poles have been replaced by side poles, and as opportunity offers the remaining centre poles will be likewise replaced. The principal tramway routes are lighted by metal filament lamps, gas-filled lamps of high candle-power being used at certain points. In all, 28 miles of streets are lighted by the tramways department, and the installation and operation of the street lighting is carried out by the tramways department's staff.

The power station and general offices are located at the Manors, on a site not far from the river. The original plant supplied direct current at 550 volts, with a total capacity of 5,100 KW. It consisted of vertical slow speed Corliss engines, the two largest being triple expansion sets of the marine type. When extensions were made in 1913 it became necessary to increase the plant, and after careful consideration of all the factors and exhaustive tests, it appeared that the limits of distribution by 550 volt direct-current from the single station had been reached. It was then decided to instal turbines with high tension generation at 6,600 volts, 40 periods, and rotary converter sub-stations. The new plant was put into commission in February, 1914, and the slow speed direct-current plant was then disused. At present the plant at the power station consists of two 3,000 KW. Parsons' turbo-alternators, while an additional set of 4,000 KW. is now being installed. There are also two 650 KW. vertical Corliss engines and dynamos. The total capacity of the plant is 11,300 KW.

Rotary converter plant with transformers, with a total capacity of 6,900 KW., is installed at the power station and sub-stations. Of the original plant only the two 650 KW. engine-driven dynamos remain, and these are at present used as a stand-by, but they can be run in parallel with the rotary converters if required. Two large traction batteries work in conjunction with the rotary converters through automatic boosters. Brown-Boveri automatic field regulators are fitted to each alternator and are inter-connected to equalise the power factor between machines running in parallel. Each alternator is protected with the well-known Merz-Price protection, combined with a field braking switch to operate in the event of the relays tripping the main oil switch. Dry cloth air filters are fitted to the two alternators, which are self-ventilated. The third alternator is to be ventilated by a separate motor driven fan through a dry type air filter.

In addition to the sub-station in the central station supplying the centre of the city, there are three other sub-stations, one situated at the east and west ends of the city respectively, and one in the urban district of Long Benton. All the rotary converter plant has been supplied by the Metropolitan-Vickers Electrical Company. The switchgear has been supplied partly by this firm and partly by Reyrolle and Company, Limited.



Reconstructed Car with Interior Staircase to Top Deck.

As events proved, the policy of installing the high tension plant was fully justified. It would have been utterly impossible to have handled the unprecedented volume of traffic in the district contingent upon the war; and only those in daily contact with the then conditions know how narrow was the factor of safety under which the plant had to be operated.

The pumping station for the supply of water for condensing purposes is situated at the river side. Three motor-driven pumps, each consisting of a two-stage turbine pump, direct-coupled through flexible couplings to a 135 H.P. motor, are installed, and on the same shaft is mounted a direct-coupled reaction turbine. Each of these sets is capable of handling 3,000 gallons of water per minute against a head of 125 ft.

Coal is delivered from the North Eastern Railway on to the power station sidings, the trucks being shunted directly over the bunkers. The steam plant consists of Lancashire boilers with superheaters, the superheat

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at the stop valve being 120 deg. Fahr. The usual Green's economisers are also installed.

In April of last year, owing to the prolongation of the coal strike, the boiler plant was adapted for burning oil fuel. The Wallsend Slipway and Engineering Company supplied their Wallsend-Howden pressure system of burning liquid fuel. The work of fitting up this plant was commenced by the power station staff on Saturday, May 7, and on the following Saturday the first set of burners was lighted and the boilers put into service that day. At that time there was just 20 hours' coal supply remaining in the bunkers. The whole apparatus worked in an entirely satisfactory way, and it was only replaced at the end of the strike owing to the cost of the oil.

The department now has 248 tramway cars, comprising 80 double truck (double or single deck) cars, 150 single truck cars, and four sets of coupled cars. Each of these sets consists of two single truck double-deck open-top cars permanently coupled together with one 35 H.P. motor fitted to each truck. It is noteworthy that 58 of the cars have been provided with the front exit, while 41 cars have inside staircases designed by the general manager of the undertaking, Mr. Ernest Hatton. Of the original single-deck cars, ten have been converted to double-deck cars with inside staircases. Air brakes of the straight air type, with the emergency features braking on the wheels and track simultaneously, have been fitted to 35 cars.

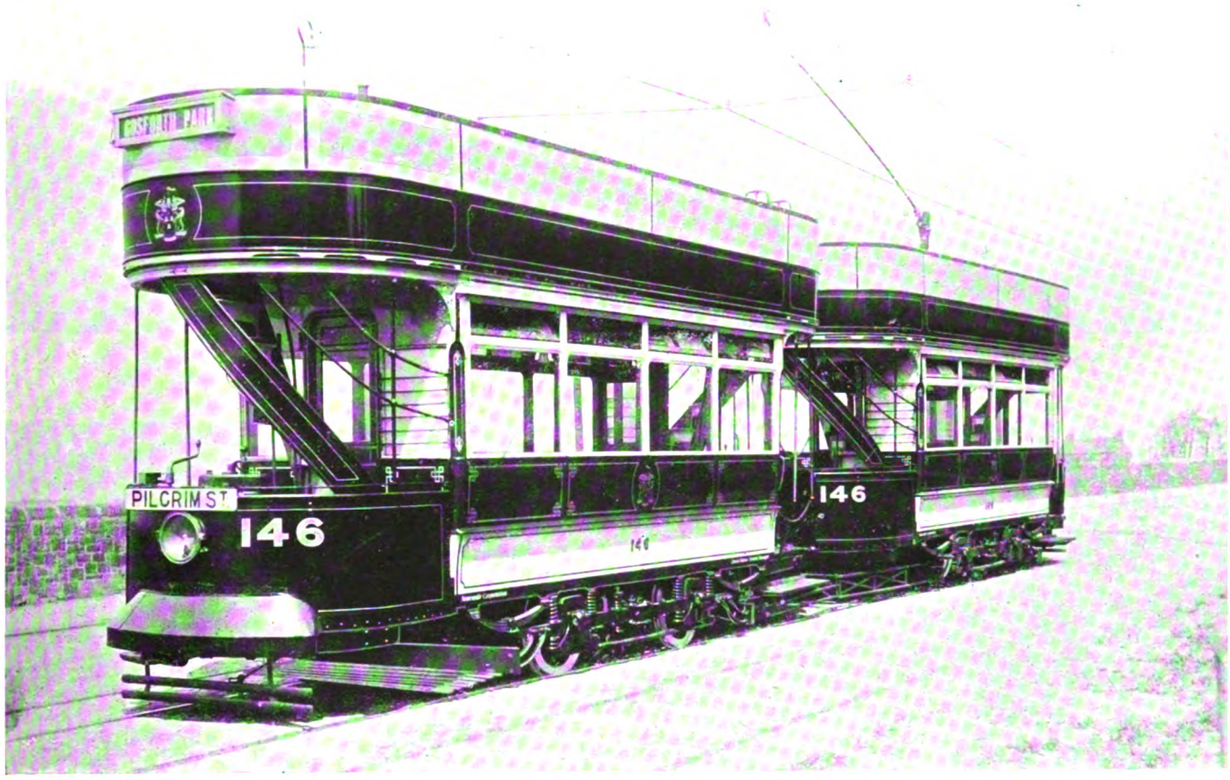
In 1919 experiments were carried out with roller bearings fitted to the car armatures. So satisfactory have these proved, that it has been decided to fit additional armature bearings in the same way and the work of conversion is now proceeding at the car works. Two types of roller bearings are used, viz., the Hoffmann roller combined with the ball location bearing, and the Hyatt spiral roller.

In addition to the tramcars, the department owns 18 motor coaches and seven double-deck omnibuses.

Owing to the extension of the system, new car sheds, garages, body building and paint shops are in course of construction at Byker.

Three electric welding sets are at present in use, one for the permanent way and two in the car works. For the permanent way a motor generator and switchboard are mounted on a 4-ton petrol motor chassis, and provide for three operators. The arrears of war time maintenance are being speedily overtaken in this way and a considerable saving in the cost of maintenance has resulted from the introduction of electric welding. Owing to the difficulties of obtaining supplies during the war period, a brass foundry was set up and it has since been in continuous operation.

The Newcastle Corporation Tramways Committee, which is responsible for the undertaking, consists of 27 members. Alderman Richard Mayne, J.P., after occupying the position of vice-chairman for a number of years, was appointed chairman n November, 1915, and during his chairmanship notable progress has been made. Mr. Ernest Hatton became general manager and engineer in 1905, and since that time the undertaking has been continuously extended and developed in various directions. During the war the responsibility devolving upon the management was of an exceptionally trying character, inasmuch as a very heavy service had to be effected under circumstances of the greatest difficulty. The undertaking came through the ordeal with notable success and it has rapidly overtaken the arrears of work which accumulated during the period when all energies had to be devoted to the maintenance of the service.



One of the Sets of Coupled Cars—Newcastle Tramways.

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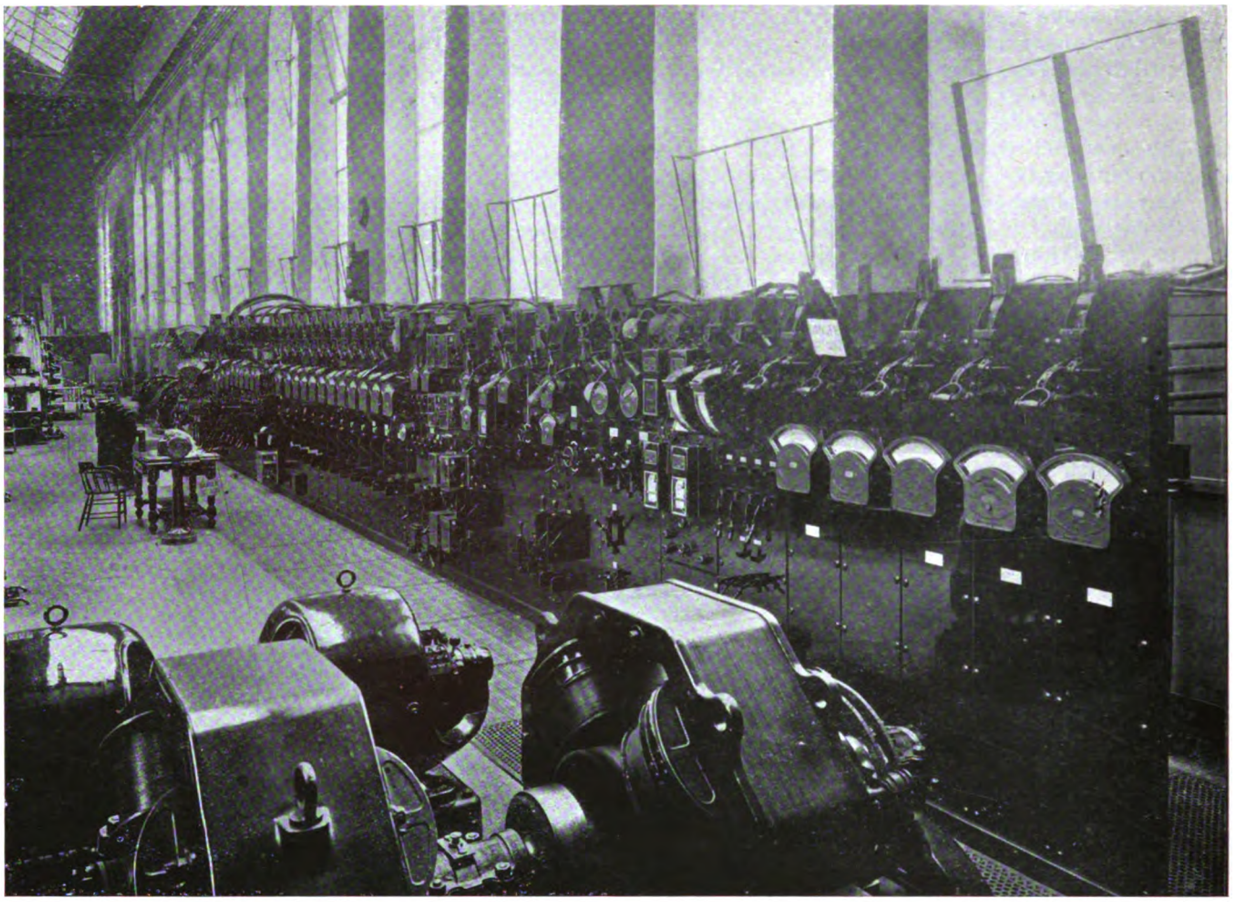
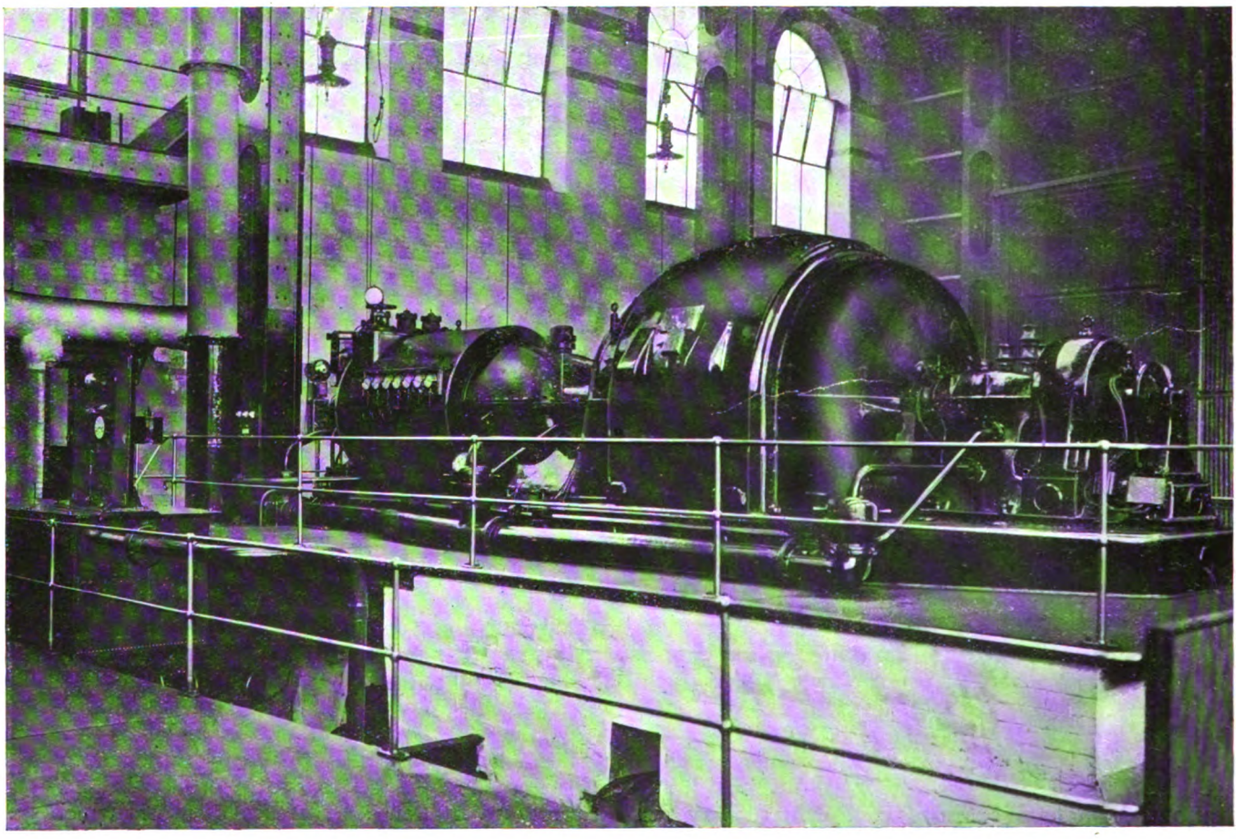


Traction Switchboard in Manors Power Station—Newcastle Tramways.



3,000-kw. Parson's Turbo-Alternator Three-Phase 6,600 Volts, 40 Periods—Newcastle Tramways.

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STEAM OR ELECTRICITY?

INTERVIEW WITH MR. ROGER T. SMITH (*Electrical Engineer to the Great Western Railway*).

The question as to how far it is practicable or wise to change traction on our main lines from steam to electricity is one that is engaging the serious attention of our railway engineers at the present time. Its importance is only equalled by its complexity, for the conditions obtaining in one country differ so materially from those of another that electrification, which might be a sound and economic proposition in the one, would by no means be wise or practicable in the other. The rash prophecies of some writers in the daily press, who have predicted the early passing of the steam engine, and the introduction of electrical traction on all our main lines in the near future, must be taken with considerable reserve, for the change in all probability will be a gradual and slow process, and carried out only on those lines where the density of traffic shows it to be economically sound.

A valuable statement on the situation was given to the writer of this article by Mr. Roger T. Smith, past president of the Institution of Electrical Engineers and the electrical engineer to the Great Western Railway; and the views of so eminent an expert in these matters will be read with interest by the readers of THE TRAMWAY AND RAILWAY WORLD.

Mr. Smith was one of those who attended the recently held ninth Railway Congress at Rome, which, he said, opened the eyes of railway men in general to the advantages and possibilities of main line electrical traction, as seen on the Italian State Railways and on the Swiss railways. There is a special reason in those countries, he states, why electrical traction on their main lines is profitable, because both of them import all their coal. During and since the war, but especially since the war, the prices that they paid for coal were exorbitant.

But both the Italians (so far as Upper Italy is concerned) and the Swiss have got enough water power to supply electricity for the greater part, if not the whole, of their electric traction; and in substituting electricity, generated from water power, for coal burnt in steam locomotives, the annual saving of the cost of this coal is enormous.

Railwaymen of all classes at the Congress were able to see the excellent traffic results and the smooth running of passenger and goods trains hauled by electric locomotives, especially in the hilly districts, where the average speed attained under steam conditions has been increased by 50 per cent., or even doubled.

In Great Britain, however, the saving in coal by electrical traction, said Mr. Smith, is of much less importance, but it has now been established that coal used for hauling a given amount of traffic, when burnt in the furnaces of a steam generating station—the steam being used to generate electricity—is about half the coal used to produce the same traction when burnt in the furnace of a steam locomotive.

In Great Britain this saving in coal is not enough, in itself, to justify electric traction on main lines, looked at from the economic standpoint. The chief saving is owing to the fact that electric locomotives can be in service for the greater part, if not the whole, of the twenty-four hours, and also that in general a given service can be performed with about half the number of electric locomotives, compared with the number of steam locomotives, that would be required to haul the same service, provided that the density of traffic is above a certain minimum.

We have not sufficient experience yet in Great Britain, Mr. Smith states, to say definitely what this minimum is in main line traffic, but in certain cases that have been worked out it would appear to be one steam locomotive for every two miles of single track. It is suggested that any case of main line traffic, consisting of goods traffic as well as passenger traffic, is worth looking into with a view to electrification if the density of traffic is equal to or greater than one steam locomotive for every two miles of single track.

The result of electrification is to increase the average speed of the trains, while decreasing the maximum speed, owing to the special characteristics of the electric locomotive as compared with the steam locomotive, thus enabling a given investment in running lines to carry more electrically-hauled traffic than steam-hauled traffic. The effect, however, might be that if a particular railway has devoted money to increasing the capacity of its lines, without at the same time increasing the capacity of its terminals, electrification might involve a very heavy expenditure on terminal facilities—that is to say, on stations, yards, sidings, etc.—in order to enable the lines to carry more traffic. Wherever there is a heavy mineral traffic—generally coal traffic—running down gradients to a port, if those lines are fully occupied they can be made to carry much more traffic—in certain cases twice as much—if they are electrified. But this increase in traffic cannot be achieved unless the terminal accommodation is adequate.

The Great Western Railway, Mr. Smith said, has lately absorbed more than thirty separate small railways in South Wales, many of them with docks attached. On some of these railways it is probable that their capacity could be greatly increased by electrification, but it is too early to say how far this is possible until the welding of most of the competing lines in South Wales under one control sets free additional terminal accommodation at the various docks from which coal is shipped in South Wales.

"The problem," said Mr. Smith, "is a very big one, and time must elapse until the working of the South Wales Railways has more or less settled down under its new conditions. But so far as the Great Western Railway is concerned, the possibility of economies from electrical traction in South Wales, and especially in the valleys leading from the collieries, will receive first consideration. It will probably be a long time therefore before consideration is given to main line electrification east of the Severn. When any one of the groups has the courage to electrify a considerable section of main line—which may possibly happen on the North Eastern line, between Newcastle and York—it is likely that several other groups will follow their lead. When that is likely to be, however, it is impossible to predict."

High Speed Electric Locomotive.—The North Eastern Railway Company have received delivery from the Metropolitan-Vickers Electrical Company of an electric locomotive with a maximum speed of 90 miles an hour and capable of maintaining an average of more than 60 miles an hour for long distances. The machine is intended to run between York and Darlington, a distance of 44 miles, and later will haul the "Flying Scotsman" train between York and Newcastle. The machine is experimental, and on its success is understood to depend largely the future of electric services on the North-Eastern system. The engine develops 1,800 h.p., and can maintain its high speed with a load of 450 tons.

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THE CORRUGATION OF TRAMWAY RAILS

CONSIDERED FROM A DIFFERENT ANGLE.

By a Technical Contributor.

The problem of rail corrugation is still insistent, and, unfortunately, still unsolved, though with the publication a few months since of the final report of their sub-committee it is understood that the labours of the Rail Corrugation Committee for its solution have terminated. Much disappointment must be felt by those responsible for tramway undertakings at this termination of an enquiry which has been in progress for nearly 14 years, namely for probably one-half the lifetime of the industry concerned. The view had been expressed, in discussion of the interim report at the conference of the Municipal Tramways Association in 1912, that proceeding on the lines then adopted, a solution of the serious questions involved should probably be reached in a period limited to, perhaps, two or three years, but now nearly ten years later we learn that, while the eagerly anticipated solution has not been reached, its attempted accomplishment has been abandoned, or deferred until some future but unspecified period.

It must, of course, be borne in mind that since the interim report appeared the war period of over four years must have seriously hampered the work of the sub-committee, whose reference was, moreover, limited to one aspect alone, the "question of the vibration of rails and foundations," but giving due weight to these aspects it is still greatly to be regretted that the matter is apparently not to be carried further. In any great industry concerted measures for the application of both scientific knowledge and practical experience to the solution of problems of obscure and difficult nature are essential to successful and economical working, as these involve annual losses which in the aggregate must amount to very large sums. Taking the whole of the tramway undertakings of this country alone, the total expenditure involved in running, maintenance and renewal charges must amount to many millions of pounds annually, the total car-miles run making a colossal figure in the aggregate. Any fractional loss per car-mile run becomes, when multiplied by many millions, a very serious matter demanding the most careful attention.

Under these circumstances it appears to be a matter for the industry itself to ascertain whether its constituent members, the engineers and managers concerned, have not already sufficient knowledge of their own working conditions and difficulties to solve the problem for themselves, if all the information available could be collected and assembled. As an already accomplished step in this direction the committee's interim report of 1912 is of very great value, as it gives the results of the collation of many replies to a large number of questions, and furnishes a number of "interim findings" to which beyond question great weight attaches, as based both on experimental evidence and on general consensus of opinion. It cannot be said that the final report of the sub-committee recently issued carries the matter much further, if at all, but the limited nature of their reference and the difficulties of the period during which part of their work was in progress have already been mentioned. If comment of a critical nature were permissible, this might perhaps be applied to the last paragraph of the sub-committee's final report, from which the conclusion appears to have been reached that "corrugation is inseparable from the action of heavily loaded wheels rolling along the surface of the tread of the rails, and that this rolling originates the corrugation by giving rise to superficial stresses in the material of the rail tread which are in excess of the elastic limit and of the toughness of that material." This conclusion appears to be somewhat in conflict with the opinions expressed by the main committee in their interim report of 1912, in which it was stated that a short experience of tramway operation and the actual production of corrugation was sufficient to show that this theory, cold-rolling by the wheels alone, left much to be explained, the report giving a number of "established facts" which did not fall in with it.

With the hope that interest in this important subject may be stimulated, the following suggestions are tentatively advanced as to one of the possible causes of this apparently obscure and baffling difficulty. If neither of the two associations concerned are able to resume the investigation, the technical journals could render great service to the tramway community by offering the hospitality of their columns for the presentment of experience and data on the subject, especially if such facts, when available, could be marshalled in due order and assessed by competent and experienced observers.

While many different reasons and causes for the formation of corrugation have been put forward from time to time, as far as can be ascertained on one occasion only has that which in the present writer's opinion is most probably the cause been definitely stated in public, namely by Mr. P. J. Pringle, M.I.E.E., M.I.Mech.E., the general manager and chief engineer of the Electric Supply Company Limited, of Victoria, N.S.W., in that part of his paper dealing with Rail Sections read before the congress of the Tramways and Light Railways Association in July 1920. In this the opinion was expressed that the steeply coned wheels which are almost invariably found on all tramway systems at present not only tend to produce corrugation of the rails upon which they run, but in addition greatly lessen the life of the rails and tyres employed, and increase the power consumption necessary for traction purposes. While no traction engineer with sound mechanical training and experience can doubt the wisdom of the views thus expressed, bearing in mind the very heavy loads which the wheels have to carry, for the present purpose argument must be mainly confined to the relation of a steeply coned wheel to the production of corrugation, though each of the matters mentioned by Mr. Pringle are in reality all bound up together and form part of one problem. Quite possibly from the financial and operating points of view the loss of power used for traction, and the increased wear of rails and tyres due to these adverse conditions, are of more importance than the losses due to corrugation, and perhaps at a later date it may be feasible to discuss these other aspects of this important problem more in detail.

It may, in the first instance, be convenient to endeavour to state briefly what, in the writer's opinion, in all probability constitutes corrugation, and secondly the probable main cause of this, with some attempt to visualise the present conditions of working. It may

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then be possible to see how far such statements will bear critical examination in the light of the experimental evidence and "findings" given in the interim report of the Corrugation Committee in 1912, and also of the general experience of men well versed in the industry.

Put in this manner, in two simple paragraphs of definition, it is suggested that—

1st. Corrugation is the manifestation of irregular wear taking place between the surfaces of wheel and rail where the conditions of working are unfavourable. It is generally most marked where the rails have least capacity to resist wear, though the tendency to corrugation is in all cases present where the conditions of working are unsatisfactory. Other factors, such as the rigidity or flexibility of the rails or foundation, may govern the extent to which the corrugation is apparent.

2nd. The principal cause, or at least one of the main causes, of this irregular wear or corrugation, is the fact that the conditions of working are such that sliding of the surfaces in contact under very heavy pressure must be caused, as well as pure rolling between them.

Looking at the conditions now present under which contact is made between tyre and rail, to say that generally these are unfavourable is to state the case in very guarded manner. Probably most tramway systems constructed for electrical working during the last 20 years in this country have made use of one or other of the British standard track rail sections, which in 1904 were all designed with an inclination of 1 in 21 for the tread of the rail, the employment of track rails with head formed to a radius having either been prior to 1904 or comparatively recent years. Though formed originally to this small inclination, the worn rails of almost all tramway systems have to-day an inclination about three times as great, 1 in 7 or thereabouts being common, and often exceeded. To form some idea of present working conditions, let a rail with head 2 in. in width be taken for ready illustration, its slope when worn being say 1 in 8. There will then be one-quarter of an inch difference of level between the two sides of the head of the rail, and of the tyre running on it, or a difference of half-an-inch in the diameter of the tyre if measured on its outer and inner sides, those next to the outer face of the wheel and the flange respectively. The tyre has consequently a circumference which differs by more than 1½ in. in its measurement on its outer and inner sides, and this difference of 1½ in. or more in its linear dimension has to be disposed of in some manner during every revolution made by the wheel on the rail, namely by sliding, which slip must take place under the same very heavy pressure under which the wheel has necessarily to roll. Wheels of this form of tread, if left unconstrained, would roll in diverging circles of a radius of 10 ft. Under present-day conditions two such wheels are fixed on one axle and are made to travel forward in a straight line on two planes tilted inwards formed by the running heads of the rails, the self-propulsion of the car being effected by the axle torque and the adhesion of the wheel tyres to the rails. Considered as an efficient mechanical combination of parts, such an arrangement stands condemned beforehand, though it is unfortunately the state which nearly all tramway undertakings have reached already, or are gradually approaching. If a mechanical engineer with, for example, large experience in the transmission of power in mills, were asked to contemplate some similar arrangement to transmit 50 or more H.P. for 16 hours a day by means of shafting, having to employ with this gear-wheels of wholly unsuitable form, he would probably anticipate a loss of perhaps 30 per cent. in the power required to be provided, as well as very heavy wear and early breakdown of the transmission, though in such a hypothetical case adequate lubrication of the working parts would assist the adverse conditions. Unfortunately in tramway practice lubrication of a sort between the surfaces of rail and tyre only takes place during wet weather, while the constant presence of road grit and sand efficiently assists the process of rapid disintegration of the surfaces in contact under heavy rolling load, coupled with sliding.

Assuming that the circumstances above attempted to be set out fairly represent the adverse conditions under which at present electrical traction on tramways has to be carried on, let us try to see how far these apparently fall in with those described in the Committee's interim report of 1912 as possibly giving rise to corrugation, or likely to do so.

Taking, first, the "findings" in the interim report, the Committee stated that corrugation appears on the rails independently of whether the wheels are being driven by the motors or not, and they expressed the opinion that the explanation of this might be the slip and skid taking place owing to the different diameters of the wheels, which difference largely resulted from the unequal wear produced by difference in the speed of the two motors. Mr. King stated in his report (read at the conference of 1912) that the Committee had ample proof that corrugation was very frequently produced at places where the power was completely cut off from the motors. The Committee also found that corrugation occurred on cable tramways, where the wheels, of course, are not driven. They also suggested, in their "findings," that the brightness of the crests of corrugation, as compared with the comparative dullness of the hollows, was due to the purely rolling action under increased pressure over the crests, and that other portions of the rails were not subjected to a purely rolling motion, hence their dull appearance. Professor Carus Wilson, speaking at the conference in 1912, on the report (see TRAMWAY AND RAILWAY WORLD, 10th October 1912) said that the Committee were of opinion that the crest was the normal condition of a good rail, and that if it were all crest there would be no trouble. It was in the hollow that the trouble arose, and that it was what happened in the hollow which proved that the wheel motion was not a pure roll. There was something combined with the roll in the shape of a skid or slip which gouged out the material or forced it to one side. He said that the Committee believed this had been demonstrated, and they asked the Association to accept this.

In an earlier part of their report the Committee, after referring to the information collected by them shewing that slip and skid were continually taking place, and that a pure rolling motion seldom took place even for one revolution of the wheel, stated that they had acquired strong evidence that the result of this continual slip and skid was attrition and cold flowing of the material of the rail, and that the general information placed before the Committee, coupled with the striated appearance of the corrugated rails, would suggest that corrugation might be created by the alternating slip or skid and rolling action of the wheel during its passage along the rail.

It is submitted that, in the "findings" of the Committee and views expressed by them, as recited above,

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and the two paragraphs in which the present writer has attempted to define what in his opinion corrugation is, and its cause, there is nothing whatever in the least degree inconsistent, but that on the contrary, these two definitions fit in exactly with the particulars given by the Committee and with their forecast as to the manner in which corrugation might be created. In this connection the Committee's reference to the reason for the difference in the appearance between the brightness of the crests and comparative dullness of the hollows, and to the striated appearance of the corrugated rails, is also of importance, as inspection of tramway rails shews that their appearance and surface texture will vary with the conditions of service. For instance, on steep gradients where track brakes are employed, or at fixed stopping-places at which magnetic brakes are regularly applied, the rail surface is generally dull and abraded by the brake shoes, as compared with the relatively bright and semi-polished surface where rolling practically alone takes place. The dull hollows in a corrugated rail must clearly be the portions at which sliding abrasion occurs.

Another important matter is the reference in the Committee's report to the fact that while almost every system had no corrugation for a number of years, these same systems now have corrugation beginning on rails very soon after laying. This was mentioned by the Committee as one of the " established facts " which did not fall in with the theory that corrugation was caused by cold rolling alone. Every engineer responsible for a tramway system has probably had experience during more recent years, when an existing tramway route has been extended, or rails have been replaced, of the occurrence of corrugation on the new rails very shortly after laying, whereas when an undertaking was first constructed the trouble generally took a long time to develop. The conditions as to contact between wheel and rail were, however, totally different in the two cases. At the earlier stage, at least until some years elasped, the cross-sections of worn rail and tyre probably did not differ greatly from their original form, whereas at present when new rails are installed the tyres running on these have their profile formed to the steep inclination of the worn rails in the majority of the length of the system or route, and make contact in the first instance with a narrow strip of the head of the new rail next to the gauge-point, the conditions in this respect being most adverse and unsatisfactory.

Further confirmation of the view last expressed seems to be forthcoming from the Committee's statement that corrugation is very common on single track where cars run in both directions, and that on some systems the worst examples are on single line under such conditions. Mr. King, in his report, commented on this, asking why it was so common, and whether cars in each direction produced it, or only cars in one direction.

The explanation of the above would appear to be the following—

In a new tramway system the change in profile of rails and tyres from the small inclination of 1 in 21, as designed, to the worn cross-section of both, say 1 in 7, or to whatever the worn inclination may amount, has taken a long period to develop, depending on the service worked, and other local conditions. Taking, for consideration, a route consisting of double track with portions of single line at places, over which single portions cars in both directions travel, the rails in the single line (which carry twice as many cars as the rails in the double track) will consequently have reached a stage in their life which is relatively more advanced in given time than those in the double track, over which only one half of the number of cars travel, and the inclined worn profile of the rails of the single line will therefore be steeper than in the case of the rails in the double track. In a few cases the writer has had clear evidence that this is so. The conditions which, as above shewn, must limit the possibility of pure rolling contact alone between wheel and rail would therefore be more adverse in the case of the rails in the single line with cars passing in both directions, and the Committee have found that corrugation is very frequent in such cases. The circumstances, stated by the Committee, that, where cars run in one direction only the marking is frequently inclined from the gauge-edge backwards, while with cars going in both directions the marking is at right-angles, would point to the conclusion that on single line the cars in both directions each have part in the production of the corrugation, and this would have appeared to be probable.

Several other matters in the interim report might be quoted as fully in consonance with the argument already advanced as to the cause of corrugation, but the space available, and quite possibly the patience of readers, renders this undesirable, especially as it is still desired to draw attention to one further aspect of the matter in illustration of the foregoing argument, and to urge the great importance of slip in relation to wear.

In the earlier days of electrical traction on tramways, when corrugation began to be apparent, it was at first generally found, as far as can now be recalled, on one rail of curved portions of the track, its pitch being of much larger dimension than that now generally prevalent on straight track, and possibly may have been connected with the torsion of the axle owing to the difference in length of path traversed by the two wheels fixed to one axle in negotiating the curve. The corrugation of the present day, appearing persistently on straight track, as the sub-committee mention in their final report, and with a pitch of from say 2 to 3 ins., necessitates, for any reasoned explanation of its occurrence, a slip taking place at very frequent and more or less uniform intervals between wheel and rail. The " findings " in the interim report stated that corrugation had been produced by every known type of electric car, and that the pitch and characteristic of the corrugation were independent of the type of car, while the pitch was independent of the speed of the cars. As compared with these different variables, the one thing remaining reasonably constant in any system (at any given period) would be the inclination of the worn tyres and rails, which as previously shewn must of necessity give rise to some definite amount of slip in every revolution. If the pitch of corrugation in any system is found fairly constant within limits, it is reasonably certain that the wheels of succeeding cars passing over the corrugated rails would synchronise as to the time interval of their slip due to tread inclination, as the pressure (and therefore the co-efficient of friction) between tyre and rail must obviously be greater at the ridges than in the hollows of corrugation. One of the Committee's " findings," in which it was suggested that the brightness of the crests was due to the purely rolling action over them under increased pressure, is wholly in agreement with this. Does it appear, under these circumstances, unreasonable to assume that in all probability the known slip of the tyres, when worn to an increased inclination, and the corrugation effect on the rails, may quite well be closely connected ? Is it not also quite probable that if a minute slip must take place in this manner many times in each revolution, the amount of slip thus caused may be accentuated by the

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axle torque during the time the wheels are being driven by the motors, or at least during acceleration, bearing in mind the fact that any sliding which takes place under torque of the axle would normally be in a backward direction? Many points of this kind, at present indeterminate, could readily be cleared up by experiment under service conditions.

Reverting for a moment to the case, assumed for the purpose of illustration of the present adverse conditions, of a rail and tyre 2 in. in width, with inclination of 1 in 8 when worn, thus having a slip of over 1½ in. per revolution, and taking for example a driving wheel 30 in. in diameter; this slip of 1½ in. in each revolution would be equivalent to about 1½ per cent. A slip of from 1½ to 2 per cent. in each revolution, due to the inclination of the worn tyres, is quite usual under present conditions. It may be thought that such a small per-centage of sliding, in comparison with the wear due to the much greater distance rolled, is after all a very small matter, and hardly worth consideration. Any such view fails to take into account the fact that this small amount of sliding takes place under the very heavy pressure under which the tyres have to roll, and if the subject is gone into carefully the contrary aspect is seen, as experimental observation clearly shows.

Tests of various samples, taken from the head portion of tramway track rails, made by the National Physical Laboratory by Mr. Saniter's method, (in which a cylindrical specimen of the material to be tested is revolved rapidly, carrying on it a loaded ring) shewed that *under equal load* the wear due to sliding abrasion is enormously greater than that caused by pure rolling alone. With a slip of only about ⅛th of the distance rolled in each revolution it was found that the average wear of a number of samples of track rail steel had increased to about 15 times as much as the wear due to pure rolling alone. Any such relation between wear due to sliding and that caused by pure rolling alone shews that a slip of 1½ or 2 per cent. in each revolution of the wheel on the rail must have a most important effect on the wear of the two surfaces in contact, and that the result of slip or skid taking place in the hollows of corrugation, as suggested in the Committee's interim report, would be very far from negligible.

As already stated at an earlier stage it is hoped that the suggestions thus outlined may have the effect of increasing interest in this important but difficult subject and may also lead to the expression in public of the experience possessed by men well acquainted with the industry, so that the cause of corrugation may be definitely ascertained, thereby adding to the common fund of knowledge. If this should be the outcome, the purpose with which this has been written will have been served. While the ultimate cure for the present adverse conditions under which contact is made between wheel and rail will still remain to be found, this should probably give rise to considerably less difficulty if, for example, inference can be drawn from the field of medical science. In this, agreement as to the accepted cause of a particular disease has generally resulted in a relatively short period in the recognised suitability of treatment directed to the cause of the complaint, rather than to its symptoms, and the present circumstances are not likely in the writer's opinion to give rise to exception in this respect.

The London Electric Railway Company recently decided to place contracts with five British manufacturers for the design and construction of a sample electric all-steel pas enger coach embodying the latest improvements, including fire-resisting and safety appliances.

THE NEED FOR GOODWILL.

On What Does Prosperity Depend?

The Industrial League and Council, 82 Victoria Street, London, S.W.1, have issued a manifesto prepared by them and signed by a large number of Members of Parliament and others who endorse the League's work for the improvement of relations between employers and employed. Amongst the earliest signatures received was that of the Prime Minister.

Subjoined are extracts from the document—

All thinking men and women agree that the world is in desperate need of goodwill, that co-operation is a vital necessity if we are to gain a world of peace, prosperity and happiness. It may be that the real cause of our inability to restore tranquillity to Europe is our failure to grasp the measure of our individual responsibility.

The world, after all, is made up of states, and states are represented very largely by associations created for political or industrial ends. What we desire and demand is that the states should keep the peace as between themselves. What we forget is that a state is no more than an aggregate of individuals giving allegiance to some form of government.

If people are concerned in their individual capacity with struggles and quarrels, if in industry they attach more importance to personal questions than to those that are vital to the well-being of the community, they create an atmosphere in which ill-feeling is the dominant factor. The result is that the industry suffers. With it human relationships suffer.

As it is with industry, so it is with the state. If the rulers think only in terms of their own country, then sooner or later the result is war. Only as they take wide views and develop a large vision, considering others as well as themselves, is peace maintained. We find states with divergent aims working in complete harmony.

The real ruler of the world to-day is commerce. It is only the worker who can build up what the soldier has destroyed. There never was a time in history when the industrialist had so much to offer or the world at large had so great a need of his services. Europe has received a staggering blow. Millions of its best citizens have been lost. Men lack necessities and opportunities while there is a vast demand for everything that Europe produces. Given goodwill, that demand can be met, distress can be relieved, employment can be widened.

We in Great Britain have the factories, the works, the skilled men, the able direction. One of the most vital things wanting is that goodwill which is the real motive power. If we are to obtain it, every class, employer and employed alike, must admit the theory of personal responsibility and must endeavour to fulfil its obligations.

If every man would so shape his acts in times when industrial crises threaten that he can feel he is fulfilling his responsibility to those who died for their country, the quarrels that have made the path of industry so difficult in the past few years would not recur. Men in every political party look forward to the time when there shall be a real settlement in Europe. Not until we achieve unity at home can we hope to achieve unity abroad. Not until all classes of the community recognise not only their rights but also their obligations, shall we achieve unity at home.

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HADFIELD'S NEW ROLLING MILLS.

Important developments have recently been completed at the East Hecla Works of Hadfields, Limited, Sheffield, giving greatly increased facilities for forging and rolling the special alloy steels for which Messrs. Hadfields are world famous. The development of modern alloy steels may, indeed, be justly said to have originated with the discovery of manganese steel by Sir Robert Hadfield in 1882. This invention opened up a new era in metallurgical research, the results of which have brought high-class steels into general use, and revolutionised certain branches of engineering. Leading metallurgists in all countries have testified to the importance of the Hadfield inventions in helping to bring this about, and many awards and honours have been conferred upon the inventor.

The applications of manganese steel to track work, dredger work, and other engineering problems are now well known, and, in fact, have made possible certain engineering problems which otherwise could not have been carried out at all. Another of the Hadfield inventions is low hysteresis steel. The total saving to the world since the introduction of this material has probably now considerably exceeded 50,000,000 tons of coal, that is in fuel alone, to say nothing of the savings in the construction and service of transformers and other electrical apparatus. It was in Sheffield that the first practical application was made of this steel by Mr. S. E. Fedden, M.Inst.C.E., general manager of the Sheffield City Corporation Electrical Supply Department, in the years 1903, 1905, and 1906.

The quality and strength of other special steels has also been developed at the Hadfield works to a remarkable degree, as exemplified by the wonderful performance of their armour-piercing projectiles, which are made by them up to 18″ calibre, and are capable of perforating the thickest and most tough type of hard-faced armour afloat. The output capacity during the war of large armour-piercing projectiles, of 12 in., 13·5 in., 15 in., and 18 in. calibres was on an enormous scale—nearly 1,000 per week.

The total area of the present works is 214 acres, of which 51 acres are occupied by buildings. Some idea of the magnitude of the work carried on by the company in steel castings will be gathered from the fact that in the various Hadfield steel foundries there are no less than 12 acres of moulding floor space.

View of Main Rolling Mill Showing Roughing and Finishing Stands.

After devoting many years to the production first of sound steel castings and ingots, and secondly of manganese, low hysteresis, and other special steels in the form of castings and forgings of all types, Messrs. Hadfields decided to add the rolling and forging of special alloy steels to their other facilities. With this end in view they have recently laid down three very complete electrically driven rolling mills, including a reversing 28 in. blooming and finishing mill, an 11 in. and a 14 in. bar mill, all of the most modern and improved types. The two smaller mills are used for rolling billets to the various commercial sizes of round and square bars, and they have also proved very useful for the production of special alloy high tensile steels for motor cars and commercial vehicles, spring steel and other special steels. The new 28 in. mill is the

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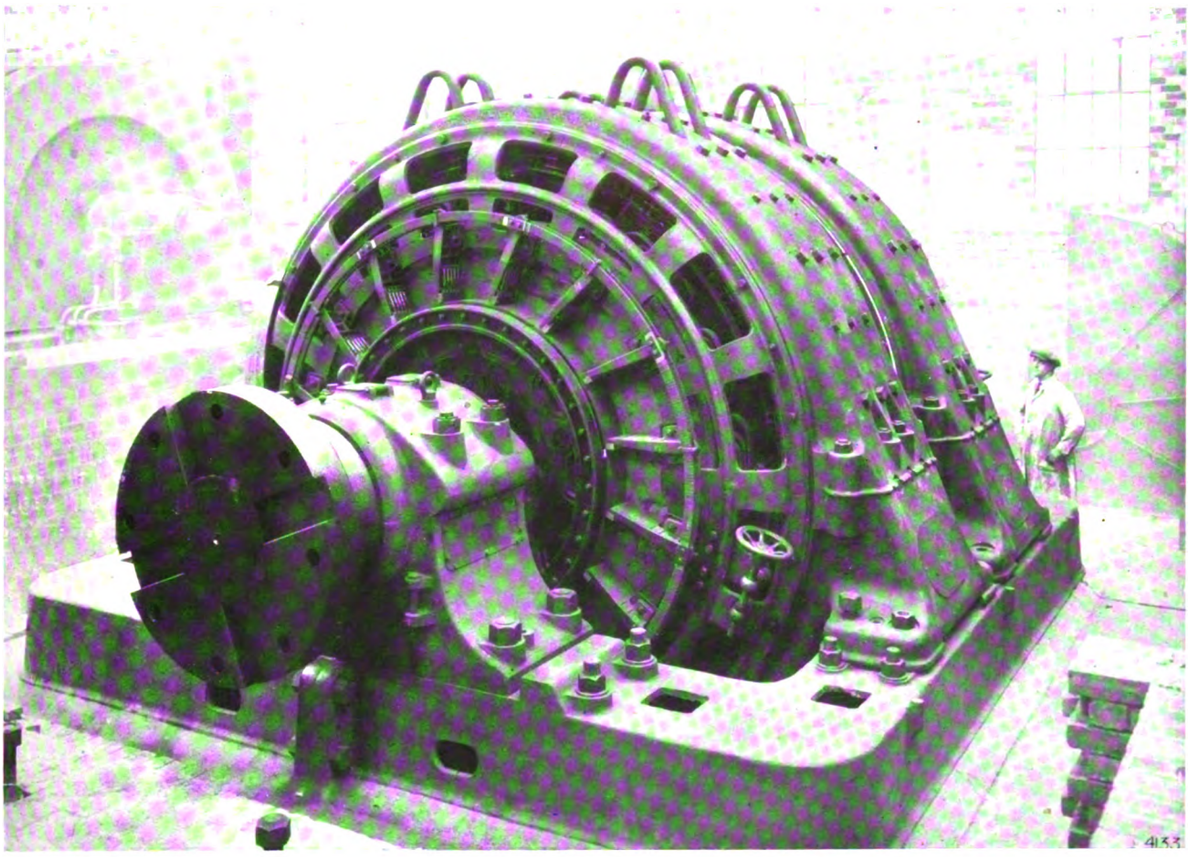
first having for one of its main objects the production of "Era" manganese steel rails of various sections.

These mills are of the continuous running bar type, each driven direct by an electric motor having a fly-wheel and flexible coupling interposed between the motor and the mill. The mills are complete with the usual reeling machines, shears, and hot saws, all driven by separate electric motors. A roll-turning department is provided, in which are installed electrically driven roll-turning lathes and the necessary equipment for the proper maintenance of the rolls. The whole equipment is laid out on modern lines, and is arranged for obtaining the maximum of production with the minimum of labour. Overhead travelling cranes handle the raw and the finished material, these having capacities of 20 tons and 35 tons respectively.

of coal per hour. A gravity roller track links the soaking pit with the continuous furnaces, while the main control platform on the approach side spans the entire width of the mill. The 28 in. mill is capable of rolling down 15 in. square steel ingots 5 in. long, having a weight of 25 cwt., and reducing them at one heat to 2½ in. square billets, the normal output being approximately 1,500 tons per week, or, say, 15 tons per hour, with a maximum output of 20 tons per hour for occasional short periods. The mill will also roll Hadfield "Era" manganese steel ingots into rails up to the heaviest section in demand, having a maximum length of about 55 ft. rolled.

This mill comprises one cogging and one finishing stand. The cogging rolls are 28 in. in diameter and 7 ft. long, and the finishing rolls 28 in. in diameter and



28-in. Reversing Rolling-Mill Motor, 3,200-11,600 h.p.

The total area covered by the new rolling mill scheme is 175,000 square feet, the rolling mill shop itself occupying an area of 80,000 square feet. This, when the area of the smaller mills is included, makes a total space covered of considerably more than five acres. The control of temperature is of great importance in special steel manufacture, and in rolling this material it is essential that the right temperature shall be maintained from the start to the finish. For this reason it is necessary to instal elaborate control devices as well as soaking pits and re-heating furnaces.

The open hearth ingots are conveyed hot to the rolling mill building. The furnaces and soaking pit, which embody all the latest modern improvements, are of the gas fired, reversing, regenerative type. The gas for the continuous furnaces and soaking pit is supplied by five gas producers, each capable of gasifying 10 cwt.

6 ft. 6 in. long. The total weight of the mill is about 1,600 tons, that is including the electrical equipment, weighing approximately 400 tons. The main rolls were manufactured by Messrs. Hadfields, and are of their special quality forged steel with machined fluted wobbler ends. The hydraulic shears are of the up-cutting type, complete with hydraulic intensifier arranged for a maximum power of 1,000 tons and capable of shearing "Era" manganese steel blooms when hot up to 10 in. square. The hot saw is of the horizontal sliding type, arranged with a blade of 60 in. diameter and driven by a 75 H.P. motor.

The motor for the large mill, built by the British Thomson-Houston Company, has a rating of 3,200 H.P. and a maximum rating of 11,600 H.P. It is capable of exerting a constant torque of 125 tons feet from standstill to 60 revolutions per minute in either direction,

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28-in. Rolling Mill with Continuous Gas-Fired Furnaces.

and gives a constant horse-power of 3,200 between the speeds of 60 and 120 revolutions per minute. The overload capacity corresponds to a torque of 453 tons feet between standstill, and 60 revolutions per minute; and 11,600 H.P. between the speeds of 60 and 120 revolutions per minute. The motor is connected to the bottom pinion by a coupling of the "Ortman" sliding type, constructed entirely of special steel, the engaging portions being renewable. It is operated by hydraulic gear.

Distant View of 28-in. Mill Showing Live Rolling Gear.

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The motor, which is shown in our illustration from the driving side, is of the double-armature type, and is shunt wound with compensating poles. The two armatures are connected in series for a maximum of 1,300 volts. Power is supplied to the mill motor from a flywheel motor-generator set comprising an induction motor of 1,800 H.P. running at 600 revolutions per minute on a pressure of 3,300 volts coupled direct to two shunt-wound compensated generators, each rated at 1,300/4,750 KW. when running at 500/600 revolutions per minute at 650 volts. The shaft extension of the outer generator is fitted with a buffer-spring type flexible coupling connected with a cast-steel flywheel of 11 ft. 6 in. diameter and 30 tons in weight, also constructed at Messrs. Hadfield's works. A water-cooled brake is provided to bring the flywheel quickly to rest in case of urgency. The mill motor and generator fields are supplied from a three-unit exciter set, which comprises a D.C. motor, mill motor exciter, and generator exciter. Power for driving the mill is taken from the Sheffield Corporation mains at 11,200 volts, 50 cycles, three-phase, and transformed by static transformer to 3,300 volts. The main mill motor is capable of being reversed from full-speed in one direction to full-speed in the other direction in three or four seconds.

The necessary appliances for carrying out the requisite treatment of the Hadfield "Era" manganese steel rails are arranged at the side of the ingoing run-out by which the rolled material is conveyed to the saw. A noteworthy feature is an electrical telegraph system established between the control platform and the electrical equipment house, by which orders can be communicated between the mill driver on the platform and the attendant in the electrical equipment house.

The hydraulic water service to the mill is arranged for a working pressure of two tons per inch, and is supplied by a set of three-throw pumps driven by a 175 H.P. motor. The floor surrounding the mill is finished off in a neat manner, the live roller gear which at the finishing mill is 320 ft. long being below the floor, and the latter presenting an even plated surface all over with the exception of the live rollers, which necessarily project slightly above the floor level.

Great progress has been made at the East Hecla Works, Sheffield, in changing over to peace production, which has been accomplished without the waste of a single building. Messrs. Hadfields are now in an excellent position for dealing with post-war work, that is general commercial work, including the production of steel castings and forgings of all kinds on a very large scale. The Hadfield Works are equally equipped for furnishing special alloy steels for automobile and aeroplane work. Hadfields claim specially high quality for their steel because in the manufacture of their ingots they employ the Hadfield sound steel system, which ensures perfectly solid rolled blooms, billets, or rails, free from unsoundness, piping and segregation; while at the same time yielding a higher percentage of finished steel than that obtained by the ordinary methods. This patented system therefore enables higher quality material to be obtained with cheaper cost of production, a combination of results not often found.

Hadfields' steel-making facilities comprise a plant of the most modern type of open hearth steel furnaces, having an output capacity of about 1,200 tons per week, together with an electric furnace plant which during the war melted not far short of a thousand tons of steel per week. With their further special steel plant for producing steel under the Hadfield system, their grand total output capacity of steel reaches the considerable figure of 200,000 tons per annum. There is no more modern plant of its kind either at home, in America, or elsewhere, and the directors are to be congratulated upon the success attending their efforts.

There are those who have said it is necessary to go to America and Germany for the most modern and systematic steel plants, but in view of the equipment of the East Hecla Works and their output, as here described, it will, we think, readily be agreed that this is wholly unnecessary, and that British engineering is quite capable of designing, manufacturing, and running rolling mill and steel forging plants second to none in the world.

BRITISH EMPIRE EXHIBITION.

Arrangements for Electrical Section.

The work of organising the electrical and allied engineering section of the British Empire Exhibition, to be opened at Wembley Park, near London, in the spring of 1924, is now well in hand. The organisation of this section has been placed in the hands of the British Electrical and Allied Manufacturers' Association, of 36 and 38 Kingsway, W.C.2, by arrangement with the exhibition authorities. The Association is making every effort to render the section a credit to all branches of this national industry, and to make it as attractive as possible to both home and overseas buyers. A descriptive pamphlet has been issued, giving the names of the Association's Council, who are virtually the controlling body, and of the co-operating committee who represent various other electrical and allied interests. The imperial significance of the exhibition is emphasised, and a general plan is furnished, showing the proposed lay-out of the grounds. The electrical and allied engineering section will be located in the northern half of the machinery section, and this section is also shown on a larger plan giving the lay-out in detail.

All British manufacturers of electrical machinery and appliances are eligible to exhibit, whether members of the Association or not. Arrangements are being made for the installation and complete equipment of an electrical power station in this section. It will contain the most up-to-date plant, and will of itself form an important exhibit. A World Power Conference, under the auspices of the Association, will be held during the exhibition. It is receiving the support of the Government department and exhibition authorities, and is attracting considerable attention in the Dominions and other countries. It will certainly be the means of bringing engineers from all parts of the world to Wembley Park.

Applications for space are being received in very gratifying numbers, and allotments are made according to priority of application. All contracts are made between the individual exhibitors and the Exhibition Company, but application must be made through the British Electrical and Allied Manufacturers' Association, on the form which has been issued for the purpose. Their members have the right of first call on the space, and are also entitled to a share of any rebate resulting from the success of the undertaking.

Electrification of French Railways.—M. le Trocquer, the French Minister of Public Works, in a recent interview, said that it has been decided to electrify the whole of the French railway system, in order to reduce running costs and obviate the importing of foreign coal. The continuous current system at 1,500 volts is being used, and either the third rail or the overhead wire will be employed. Important sections of lines are now undergoing electrification. It is anticipated that the Midi company's system will be completed in 1926. This system has been first dealt with as there is plenty of water power available in the Pyrenees. Good progress is also being made with the Orleans line, and in four years the line from Paris to Brive, with many branch lines, will have been electrified. Elaborate plans have been made by the P.L. and M. Railway for the use of water power of the river Rhone, which will provide, together with the waterfalls of the Alps, the necessary current. The electrification of 93 per cent. of the company's line will have been completed in four years' time, including the routes linking up with the Italian railways. Then will follow the equipment of the main line from Paris to Marseilles, Lyons, and Geneva, as well as the Paris suburban system.

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THE EDITOR will be glad to consider articles by experts. All information of a practical character relating particularly to the engineering and operating branches of transportation will receive prompt attention. Original illustrations will also be welcome.

LONDON, SEPTEMBER 14, 1922.

Rejection of Arbitration.

Unless the Transport and General Workers' Union adopt a more reasonable attitude there seems little possibility that the tramways of the country can escape a strike of employees that will be more or less effective in bringing about a cessation of traffic. While the ultimate result of such a hold-up cannot be in doubt, it is undeniable that the greatest sufferers will be the employees and their families. The men's Union, too, are in danger of having their funds exhausted, and it is certain that it will be useless for them to look for aid to other unions. The latter are, with the exception of the railwaymen's organisation, without funds as the result of unsuccessful strikes during the past two years. In a far lesser degree the finances of the tramway undertakings are bound to be affected, but as expenditure will be largely curtailed in the event of a general strike the undertakings are in a position to hold out as long as a dispute lasts. The inconvenience to the public should be much less pronounced on this occasion than during any previous trouble, as there will be a much larger number of coaches and other motor vehicles available for transporting the public to and from their daily avocations. During the reduction of services due to the coal strike tramway employees had evidence of how successfully this alternative transport can be employed in an emergency, and as the motor coach season is just ending the full strength of these vehicles can now be utilised. The men will hardly expect to receive much sympathy from the public, for all classes have had to face reductions of the cost of living bonus to a far greater extent than has been the case with tramway workers. Indeed, in many occupations the bonus has been entirely wiped out. Notwithstanding the failure of proposals put forward by both sides of the National Joint Industrial Council, there is no reason why another effort should not be made to arrive at an agreement. The employees wish to have the present position continued for another twelve months. To this proposal the employers advanced the reasonable suggestion, which was unacceptable to the union's representatives, that both sides should agree to accept arbitration at the hands of the Industrial Court. It is difficult to see what possible objection the men can have to this proposal, unless they already admit that their case is weak. In any further negotiations the guiding consideration must be based on the fact that during the current year municipal tramways are being subsidised out of local rates to the extent of £261,000, and that the losses incurred last year amounted to £840,000, while at the same time passengers are clamouring for lower fares.

Trailers Development.

Apart from all the ordinary grounds of tramway operation on which the running of trailer cars by the London County Council has justified itself, it is of interest to learn that Mr. George A. Green, the general manager of the Fifth Avenue Coach Company of New York, recognises that there are possibilities in regard to the use of trailers for omnibuses. Mr. Green adds that this is a matter upon which he and his staff are now working. Trailers are no novelty for commercial motor vehicles, though hitherto the regulations have not permitted so extensive a use of them as is allowed with the traction engine. Though so long a train is not desired for the commercial

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tractor, it is not surprising to find that, under the new regulations proposed by the Departmental Committee appointed by the Ministry of Transport, provision is to be made for the carrying of heavier weights both on the tractor and the trailer. London experience of tramway trailer operation during the past decade and a half has from every point of view demonstrated the shortsightedness of the police authorities in opposing the County Council's application to Parliament. Scotland Yard based their case on the absurd contention that two cars coupled would cause more obstruction than one. That this plea had not a shadow of evidence to support it was shown in the worldwide review published at the time in these columns, the article being based on data obtained from many cities where trailers were in use. The conclusions therein set forth have been in every respect borne out in London practice. Especially was this the case during the war, when it was almost impossible to obtain new cars needed to carry the increasing number of passengers. The shortage of rolling stock continued into the second year after the armistice, and trailers throughout that long period proved to be a priceless boon during the rush hours. So great is the public appreciation of the advantages of coupled cars that, in the recent newspaper discussion on the question of cutting out some of the request stops, the suggestion was made that the rush period would be shortened if more trailers were utilised, to be operated as a semi-express service. The author of the idea overlooks the fact that the Council are steadily adding to the number of trailers, and that it is not possible to adopt semi-express working. The reason is the very simple one that a through full load cannot be assured. Moreover, when the cars are full many of the request stops are of necessity cut out. Would-be passengers are notified of that fact by the display of the "full" indicator over the front and rear platforms. Another consideration is that trailer traffic has been considerably speeded up during the past half-year by the introduction of new tractor cars propelled by more powerful motors. Taken on the whole there is little ground for criticising London tramway speed. The only improvement we can suggest is that motormen should take care to maintain the maximum permissible speed where other traffic presents no obstacle.

Importance of Publicity.

A correspondent who recently visited a large number of centres in which there are tramways, omnibuses, and coaches, suggests that more attention should be given to the provision of means for aiding strangers to use the local transport systems in order to visit places of interest. In several instances our correspondent made inquiry of conductors as to interesting features that could be seen by means of a journey, and no doubt similar questions are put by many strangers who are on pleasure bent. When, as in the instance mentioned, no information is obtained, the conclusion can hardly be resisted that publicity work has not received sufficient attention. The supply of a folder, containing a map and references to places of interest ought not to be neglected in a town of considerable size. In some few cases this want has, indeed, been fully met by the tramway or omnibus management. Perhaps the most notable instance of the kind in this or any other country is to be found in the example of the London General Omnibus Company and its allies. By establishing a publicity bureau—which has become a model to the world—the Underground group recognise that travelling facilities must be made known if it is desired that the public should take advantage of them. The traffic inducement will not follow the mere provision of printed matter. There must be continuous advertising in the newspapers not only directing the attention of the public to maps to be obtained in cars and omnibuses, but giving an outline of places worth visiting and the means of reaching them. This work is capably accomplished both by the London Underground group and the London County Council Tramways. During the present year both of these organisations have extended such advertising to the local newspapers. A particularly effective use of this medium is made by the insertion of a road map showing how passengers can be brought right into the heart of London by the tramways and omnibuses passing their doors. The correspondent also suggests that the management should make sure that painted or printed notices of facilities are not rendered ineffective by weather. He appears to have discovered notice boards whose condition left much to be desired. It has been said that eternal vigilance is the price of liberty; the maxim might be applied with equal truth to the successful operation of public transport services.

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PROPOSED WAGES REDUCTION.

EMPLOYEES' STRONG OPPOSITION.

The question of the proposed reduction of wages continues to hold a foremost place in the minds of employers and employees in the tramway industry. It is hoped that a peaceful settlement may eventually be reached, although up to the present little, if any, progress appears to have been made in that direction. The proposals were considered by the National Joint Industrial Council on August 25 (when Alderman H. Brown, of Leeds, presided), and the employees' representatives urged that the present agreement should continue for another twelve months. The alternative suggestion by the employers that the proposals of both sides should be submitted to the Industrial Court, with the understanding that both parties should agree in advance to accept the decision, was rejected by the employees' representatives. The Executive Council of the Transport and General Workers' Union has resolved to resist strongly what it describes as "this present attack of the employers on the existing wage standard." Branches from various parts of the country have sent assurances to headquarters that they are prepared to back the Executive Council in whatever action it takes. The campaign against the reduction in wages was opened with a mass meeting of tramway men in Manchester on September 3, when an address was given by Mr. Ernest Bevin, the Union's negotiating secretary. A resolution was unanimously passed instructing the executive of the Union to oppose the reduction, and specially to decline reference to an Industrial Court, for the reason that (to quote the terms of the resolution) "past experience has proved that it is impossible to obtain from any Government arbitrator an unbiassed decision." Similar resolutions have been passed in many other tramway centres, and there is a possibility of a strike, although it is to be hoped that a more reasonable attitude will be adopted on the part of the employees' leaders, and that the matter may be dealt with in a way that will be less detrimental to the employees. The case for the employers has been cogently set forth in the metropolitan and provincial press in numerous communications by Mr. J. Beckett, general secretary of the Municipal Tramways Association. A delegate meeting of the tramway section of the Transport and General Workers' Union is to be held in London on September 18 to consider what course shall be taken.

City and South London Railway Reconstruction.—The stations between Euston and Moorgate on the City and South London Railway were closed from August 8 in order that the reconstruction of the tube might be carried out. The closed stations will not be re-opened until the work of enlarging the tubes has been completed. The diameter of the tubes will be increased from 10 ft. 6 in. to 11 ft. 8¼ in., so as to permit through trains of the standard Underground pattern being run through from Clapham Common to Edgware. Other improvements to be made in this railway include the lengthening of the platforms, the rebuilding of the stations, and the erection of escalators at some of the stations. The task of linking up the C. and S.L.R. at Euston with the Camden Town Station of the Hampstead line, and the extension of this line from Golders Green to Edgware was begun on June 12, and the work is being actively carried on. It is hoped that the reconstructed lines will be open for traffic from Moorgate Street to Hendon about October 1, 1923. While the C. and S.L. Railway is closed for the reconstruction of the tubes, a special service of motor omnibuses is being run from Euston Station to Moorgate Street Station. These omnibuses work in conjunction with the revised time table of trains, and will stop only at the closed Underground stations. To distinguish them from the regular "General" omnibuses running on the route the special omnibuses are painted blue and cream, and are thus easily recognisable.

Wellington (N.Z.) Tramways.—A Power Station and Tramway Committee appointed by the Wellington (New Zealand) City Council to investigate the general control and conditions of the tramway services in the city, has made the following recommendations—Car shed extensions, estimated cost £25,000; new cars, £84,000; duplication of lines, £25,000; construction of limited number of double-decker cars to cope with rush traffic. When the Mangahao hydro-electric scheme is completed the Council will take the power for its tramways from this source. Three rotary converters will be installed. It is estimated that the largest will cost from £50,000 to £60,000.

Underground Staff Suggestions.—The Underground companies last month received no fewer than 325 suggestions from members of the staff for improvements in working. Twenty-two of these were accepted by the management and awards made.

FINANCIAL REPORTS AND MEETINGS.

SAMUELSON TRANSPORT COMPANY.—Mr. Cecil S. Windsor, of Harewood, Slough, Bucks., has been appointed receiver and manager of the property of the Samuelson Transport Company, Limited.

LEEDS FORGE COMPANY, LIMITED, have announced that owing to depression in trade and loss caused through the engineers' strike, it is not proposed to pay the usual interim dividend on the preference shares.

CHESTER CORPORATION TRAMWAYS show a profit of £472 for the year ended March 31, 1922, compared with a loss of £1,439 in the previous year. It has been decided that at present fares cannot be reduced.

BRITISH COLUMBIA ELECTRIC RAILWAY.—The British Columbia Electric Railway Company has declared 3¾ per cent., free of tax, both on preferred and deferred ordinary stocks, in respect of year ended June 30, 1922, payable September 7.

SHEERNESS AND DISTRICT ELECTRIC POWER AND TRACTION COMPANY.—The net revenue for 1921, after charging debenture interest, etc., was £3,289, converting the debit balance brought down into a credit of £1,735, which is carried forward.

W. T. HENLEY'S TELEGRAPH WORKS COMPANY, LIMITED.—A dividend has been announced on the preference shares at the rate of 4½ per cent., less tax, for the half-year ended June, and an interim dividend on the ordinary shares of 1s. per share, less tax.

UNITED STEEL COMPANIES' DIVIDEND POSTPONED.—At their recent meeting the directors of the United Steel Companies decided, owing to the continued trade depression, to postpone the payment of the half-yearly dividend on the cumulative preference shares, due September 1.

YORK CITY TRAMWAYS.—For the year ended March 25, 1922, there was a profit of £1,807, but there was a loss of £1,841 on the motor omnibuses and railless cars. The latter appear to have been run very economically, but they are used on lines of light traffic, which accounts for the loss.

ILFORD URBAN COUNCIL TRAMWAYS.—The approximate financial result for the year ended March 31 is a gross profit of £18,300, and a net profit of £7,620. In view of the unrestricted omnibus competition, the Council and the manager (Mr. L. E. Harvey) are to be congratulated upon so satisfactory a result.

FODENS, LIMITED.—The profit for the year to June 30, after allowing £10,138 for depreciation of plant, etc., and crediting £15,920 for appreciation of investments, was £10,756, making available, with £37,354 brought forward, £48,110. A dividend of 6 per cent., free of tax, has been declared, and £29,666 carried forward.

ABERDEEN SUBURBAN TRAMWAYS.—The profit for the half-year ended July 31 was £1,971. Including £3,343 brought in, there is a balance of £5,314. The directors propose to add £1,000 to the renewal and depreciation account, making it £23,300, £2,027 being carried forward. The dividend is at the rate of 7 per cent. for the year.

SOUTHPORT CORPORATION TRAMWAYS.—The report for the year ended March 31 showed that the receipts amounted to £78,943, a decrease of £2,055 on the previous year. This drop has been chiefly due to the reduction of the service of cars during the coal shortage last summer. The working expenses amounted to £51,242, a decrease of £5,067, explained largely by the reduction in wages, cost of power, and a decrease in the mileage. The gross profit of £27,701 was a record for the undertaking, and £3,102 higher than last year.

UNITED ELECTRIC TRAMWAYS OF MONTEVIDEO.—At the annual meeting in London recently, Sir George Touche (the chairman) said the action of the municipality of Montevideo early this year in seizing the company's undertaking following a strike by the employees had been condemned by the Uruguayan press, and the lack of respect for the rights of others had caused alarm to all the foreign concerns in Uruguay. The measures for the seizure of the company have been temporarily raised by order of the Courts, pending a legal settlement of the whole question.

KIRKCALDY CORPORATION TRAMWAYS.—The annual report of this undertaking (of which the general manager is Mr. O. F. Francis) shows that the gross profit for the year ended May 15, 1922, was £4,348, as compared with £6,730 in the previous year. After payment of interest, sinking fund and depreciation, there is a net deficit of £2,526. The total income was £36,799, and the working expenses amounted to £32,450. The total operating costs per car-mile were 18·34d., and the average traffic receipts per car-mile were £20·603d. The passengers carried numbered 4,747,799.

ABERDEEN CORPORATION TRAMWAYS report a net profit of £15,089 for the year ended May 25. This is a record surplus in the 23 years'

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history of the undertaking, and this result has been obtained in the face of a decline in the number of passengers carried of 1,866,419. Economies in working were, however, effected, and there was a reduction in working expenses of £19,606, equivalent to 12·44 per cent. This reduction included £3,138 due to wage decreases. The motor omnibus undertaking showed a gross profit of £3,207. The gross profit of £46,639 was £12,754 more than in the previous year, and the net profit was shown after setting aside the sum of £31,550 for interest and sinking fund, depreciation, etc.

GLASGOW CORPORATION TRAMWAYS.—The accounts of the various departments of Glasgow Corporation were considered at a special meeting of the Corporation recently. Treasurer Kelly, in submitting the accounts of the Common Good of the City for the year ended May 31, said that without the tramways the Common Good would be yearly a minus quantity, and it would only be a matter of time before its present surplus assets would disappear. The surplus on revenue account for the year which has closed of £116,400 was made up of the surplus on the tramways for the year of £150,000, less deficits on other sections of the Common Good, leaving a net income of £33,600. This sum goes to increase the surplus assets of the Common Good.

TYNESIDE TRAMWAYS AND TRAMROADS COMPANY.—Mr. G. E. Henderson, presiding at the half-yearly meeting, said that the receipts and expenses for the first six weeks of the current half-year showed that the undertaking was in a better position than last year at the same time. He believed the improvement would tend to continue. During the past year they had been able to reduce their expenditure by £9,456, so that the gross profit was £4,134, which was £653 less than the corresponding period of last year. The reserve fund has been increased by £655, and now stood at £4,761. He regretted that the dividend on the ordinary shares was 2 per cent., as against 3 per cent. paid in June 1921, but in view of the present slackness of trade he thought they might congratulate themselves that they had been able to pay the dividend. The report was adopted.

SINGAPORE ELECTRIC TRAMWAYS.—Debenture holders and shareholders have been informed that, owing to the urgency of the matter, it has not been found practicable to carry out the authority given by the debenture holders at the meeting on July 26, as it appears that the creation of an effective security, to be given to the Shanghai Electric Construction Company, would involve a serious delay in consequence of the necessity of such security being registered in Singapore. With a view therefore to minimising delay, and as a precautionary measure, it was decided to apply to the court forthwith for the appointment of a receiver for the debenture holders, and on August 3 an order was made appointing Sir Wm. Plender, G.B.E., receiver and manager. Money may be borrowed by the receiver without the necessity of registering a new security in Singapore, and in this way effect will be given, although in a different form, to the course of action sanctioned by the debenture holders.

COVENTRY'S TRAMWAYS AND OMNIBUSES.—Remarkable figures were quoted by the chairman of the Coventry Tramways Committee (Mr. E. O. French) in replying to a letter suggesting the use of omnibuses in place of the tramways. If they pulled up the tramway track, Mr. French estimated the interest and sinking fund would be £16,000 a year for the next twenty years. With regard to the suggestion of a three-minute service of motor omnibuses, this would mean that in place of the present 40 vehicles in service 124 omnibuses would be required, and that would entail a capital expenditure of approximately £300,000. It must be realised that the total cost of operating one omnibus in regular service annually was approximately £2,500 (including £750 for drivers' and conductors' wages), and £835 for motor spirit. The operation of the 124 omnibuses would thus mean a cost of £310,000 per annum. The accounts for the year ended March 31 showed a deficiency of £18,448. The committee decided to recommend that the deficiency be met out of the rates.

BRAZILIAN TRACTION LIGHT AND POWER COMPANY, LIMITED.—A few weeks ago the directors announced that a dividend would be paid of 1 per cent. on the ordinary shares on September 1. It has since been reported, although not officially confirmed, that a further dividend of 1 per cent. will be paid on December 1. If this be done Brazilian traction will apparently again be placed on a 4 per cent. basis. The last quarterly dividend of 1 per cent. was paid in 1915, and since then the ordinary shareholders have received no return. The condition of the company seems, however, to be such that a 1 per cent. dividend may now be resumed, and it is to be hoped that there will be no further interruption. The last report of the Company shows that in Rio de Janeiro 251·55 miles of tramway are in operation, so that eight miles have been added since 1918, as well as 70 motor cars, bringing the total number to 598. There are also 523 trailer cars and 88 goods cars equipped with motors, and 103 goods trailer cars. The miles run aggregated 30,735,543, and the passengers carried numbered 308,067,944. The receipts from the tramways, including motor omnibuses, were 9·46 per cent. greater than in 1920. In Sao Paulo the company has 150·74 miles of lines and 330 motor cars, 82 trailer cars, 59 goods cars with motors, and 48 freight trailer cars. The cars ran 12,763,282 miles, and carried 103,777,334 passengers.

WAGES IN AUSTRALIA.—At the 18th ordinary meeting of Kalgoorlie Electric Tramways, Limited, held in London recently, Mr. A. H. P. Stoneham (chairman) said the miners' award caused dissatisfaction among the tramwaymen, with the result that they struck. After the judge of the Arbitration Board had threatened to de-register the union and cancel the award under which the men were working, they returned to work. What with labour troubles and a large number of people leaving the district, the traffic receipts fell to £27,860, as against £36,895 for the previous year, while the operating expenses were £79,606, as against £27,275. The net profit was £5,817, as against £8,742. They had this year, for the first time, to pay the new corporation profits tax, which amounted to £341, and although the profits this year were less than last year, they were affected by the three years' average, and as compared with last year the tax showed an increase of £724. Their agreement with the men would terminate at the end of June. So far they were not advised of any action being taken by them, but the Australian Tramway Association had prepared a new log, under which the wages demanded were for drivers and conductors for first six months, £6 8s. 6d. per week; next twelve months, £6 14s. 6d. per week; and thereafter £7 0s. 6d., but he did not gather how many hours per week had to be worked. It looked as if once again they would have to negotiate with the men to try to come to some arrangement, so as, if possible, to avoid the expense of the manager going to Melbourne to appear before the Arbitration Court.

BURNLEY CORPORATION TRAMWAYS.—For the year ended March 31, the total receipts were £163,057, while the working expenses were £144,631, leaving a net revenue of £18,426. After deducting interest and sinking fund £14,915, bank interest £1,000, rents for tramways owned by outside authorities £1,443, income-tax £3,381, there is a loss for the year chargeable to the borough fund of £2,313. The revenue showed a decrease of £17,733, and working expenses a decrease of £23,508. The general manager (Mr. Henry Mozley) points out that the results for the two years are not comparable, owing to the prolonged coal stoppage, which caused a serious loss of revenue. The receipts for the three months during the coal stoppage showed a loss of £14,592, but there was a decrease of 221,286 car-miles, equivalent to £10,163. The repairs delayed by the war are being gradually overtaken. During the past year five single-deck cars were added, costing £14,549. The cars were required to deal with the excessive loads at certain hours and to facilitate the through excursion traffic between the Burnley tramways and the light railways of Nelson and Colne. The number of passengers carried during the year aggregated 19,164,508, a decrease as compared with last year of 4,242,848. The traffic receipts per car-mile were 25·66d., an increase of 1·25d. The expenses were 22·80d., an increase of ·06d. The percentage of working expenses to receipts was 88·70, a decrease of 4·3 per cent. The Corporation has now 72 cars and 22 miles of track.

EDINBURGH CORPORATION TRAMWAYS.—Mr. R. S. Pilcher (general manager), in his report for the year ended May 15, states that during the year electrification of the first section of the tramways, comprising five routes aggregating 7 miles 84 yards, was completed. Preparations for the electrification of the next section, comprising five additional routes (9 miles 1,661 yards), are well advanced. The total revenue on the combined cable and electric lines and the omnibus service amounted to £834,341, an increase of £43,260. The passengers carried aggregated 101,026,763, an increase of 3,041,881. Partly owing to the slightly lengthened fare stages, the revenue during the latter part of the year showed a tendency to decline, but the prevailing bad trade was a more important influence in the reduction. Working expenses amounted to £454,423, a decrease of £59,694, largely accounted for by the discontinuance of certain cable routes and the substitution of a less frequent service by omnibuses. The balance carried to the credit of net revenue was £116,989. Deducting contributions to interest and sinking fund, £69,441; special expenditure, £3,007; and income-tax, £19,970, there was a net surplus of £24,571, which in the transition conditions under which the department has been working, is quite satisfactory. There are 184 cable cars and 45 electric cars. The revenue from the 72 motor omnibuses was £183,739, an increase of £90,739. The passengers numbered 20,407,736, an increase of 10,248,926. Working expenses amounted to £140,748. Deducting interest and sinking fund, £21,828, there is a surplus of £21,163. Pleasure tours by 15 motor coaches added £9,647 to the revenue. The receipts from the parcels delivery service amounted to £2,904 for the delivery of 261,265 parcels. The wages of the employees, which in July 1920, had reached 42s. above the pre-war wage, have been reduced by 10s. Mr. Pilcher remarks that the reduction is not sufficient to warrant any reduction in fares.

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TRAMWAY AND LIGHT RAILWAY NOTES.

ABERDEEN.

SAFETY BY-LAW.

A fine of 15s. was imposed upon a motorist for contravening the new Town Council by-law requiring vehicles to draw up when approaching a tramway station indicated by a notice board and where passengers are boarding or alighting from a car. The Procurator Fiscal said that now the by-law had been introduced, tramway passengers felt more confident when boarding a car. As they did not now have the same fear they must have additional protection. Bailie Lewis said that the public should note that it was their duty to get on and off the cars as quickly as possible. The Tramways Committee have come to an agreement with their employees about new working conditions. These provide for a 48 hours' week of six days, no schedule of weekly duty to be less than 44 hours or more than 52, and no schedule of daily duty to be less than 6 hours or more than 10 hours. Other conditions include a stipulation that employees shall have 8 days' holiday annually, with pay, after twelve months' continuous service; also that in the event of a partial stoppage in the service from causes beyond the control of the tramway authority, the latter is to consult the employees with a view to enabling the work to be divided equitably among the employees. Excess duty is to be paid at the rate of time and a quarter for the first two hours, and time and a half thereafter. The Committee have decided after investigation not to propose a reduction of fares at least for another year.

BIRMINGHAM.

TICKET RETENTION.

The Birmingham magistrates recently held that a passenger on a tramway car is called upon to retain his ticket until he actually leaves the vehicle. A defendant, it appeared, had thrown his ticket on to the floor of the car and refused to pick it up when asked to do so. He said he was just leaving the car when the inspector spoke to him, and he complained of the uncivil way in which he was asked to pick up the ticket. The magistrates inflicted a fine of 5s. for the failure to produce the ticket.

BRIGHTON.

SPECIAL RACE FARES.

Although the Town Clerk stated that charges of 1s. and 6d. would be equally illegal, the Town Council decided that 6d. should be charged on special cars up the Race Hill on Brighton race days. Prior to 2.30 p.m. ordinary fares were to be charged on all down cars. For a special service from the railway station to the top of the Race Hill 1s. was charged.

BRISTOL.

FUTURE OF THE TRAMWAYS.

The Bristol City Council propose to reconsider the question of buying the tramways. The *Western Daily Press* says that the consensus of opinion is strongly against the purchase. The view is expressed that the tramways cannot be worked successfully by the municipality, and that at the present time the cost of purchase would be prohibitive. The question for the Council is whether a resolution should be passed ordering a notice in writing to be given to the Bristol Tramways and Carriage Company, Limited, to require the sale of the tramway undertaking under the Tramways Act, 1870.

EDINBURGH.

MUSSELBURGH TRAMWAYS DECISION.

The Scottish Provisional Order Commissioners have found that the provisional order promoted by Edinburgh Corporation has not been proved as regarded the proposal to acquire the Musselburgh and District Electric Light and Traction Company's undertakings. For the Corporation it was urged that it was desirable that the larger system should be the controlling body. For the company, it was objected that in nineteen years they had spent large sums in reconstructing the track and rolling stock. They had suffered considerably during the war, and now, owing to the electrification of Edinburgh tramways, their chance had come to recoup themselves in some measure.

GLASGOW.

FARES—EXTENSIONS—JACKS.

Following upon a report of the general manager on a proposal for the revision of fares, the Tramways Sub-committee decided to make no change. The Sub-committee on Extensions propose to undertake schemes which will provide employment for some 400 men. It is estimated that the whole of the tramway extensions contemplated will entail an expenditure of over £500,000. In returning a verdict of accidental death, and exonerating the driver from blame, in regard to a child who was knocked down by a tramway car, the jury expressed the opinion that the Corporation should see that the drivers were better instructed in the use of jacks for lifting cars.

ILFORD.

BELGIAN RAILS.

The Urban Council recently discussed at considerable length the question whether to obtain rails from abroad or to pay a higher price for British material. The price quoted for British rails was £12 a ton, while a Belgian firm offered to supply the rails through a British firm at £9 per ton. It is stated that the Belgian rails formerly purchased by the Council have given excellent service, and the Council took the view that having regard to the great difference in price they were justified in buying in the cheapest market.

IPSWICH.

RAILLESS CARS.

Experiments with railless trolley vehicles are to be made. The Tramways Committee have arranged for the hire of three vehicles from Railless, Limited, for the trial, the estimated cost of which was £700. A report will be made to the Council upon the results, and as to whether it would be advisable to abandon the tramways and adopt generally the railless trolley system.

LIVERPOOL.

CHARGES FOR LEFT ARTICLES.

Cloak-room fees are now charged for the storage of articles found in the tramway cars, the rate for jewellery being up to 5 per cent. of the value for a week and up to 10 per cent. for each additional week.

LEEDS.

FARES.

Leeds Tramways Committee have considered the question of reducing fares, and it is expected that a decision will be reached shortly. The effect of the proposals, if adopted, will be a reduction of 25 per cent. on the ordinary fares. In this case the fare for a mile will be 1d., two miles 1½d., three miles 2½d., four miles 3d., etc. At present the first three miles are at the rate of 1d. a mile, subsequent mileage being a halfpenny per mile extra. An extension is also suggested for the time during which workmen's fares are granted from 7.45 to 8 a.m. In regard to the question of substituting motor omnibuses for tramway cars, Mr. J. B. Hamilton (general manager of the Leeds Tramways) has been interviewed by the *Yorkshire Post*. Mr. Hamilton is not in favour of any such change. In his opinion, motor omnibuses could not carry all the great tramway traffic of a big city, owing to the limited capacity of the petrol-driven vehicle. The limit for some of the London omnibuses, which run on roads of an altogether different class, is 34 passengers, though the new "K" and "S" types can carry a larger number. It is doubtful, however, whether the big omnibuses can be regarded as satisfactory, even on absolutely smooth road surfaces. No other vehicle better serves busy areas, both as regards carrying capacity and economy in operation, than the overhead electric tramway car. It is, Mr. Hamilton thinks, far and away better than the motor omnibus and more comfortable. It may be mentioned that the question arose in regard to certain routes in Manchester—not in Leeds.

LONDON.

FARES—LUGGAGE—SPEED—QUEUES—STOPS.

The Highways Committee of the London County Council have not yet come to any decision as to revision of fares or the granting of transfer and return tickets. As recently as last December reductions were made which were expected to yield a surplus of £4,000, but the year's working showed a deficit of £88,000. It was stated that the fare of 1d. for ·56 of a mile on the Harrow Road tramways, leased to the Metropolitan Electric Tramways, Limited, was approved by the Ministry of Transport, although on lines worked by the Council 1·2 miles was given for 1d. and the company were entitled to charge a minimum of 1½d., but they introduced penny stages in December, 1921. It has been decided that personal luggage for which a charge is made must be handed by the conductor to the motorman to be carried on the front platform, and passengers will not be allowed to leave articles on the conductor's platform. The Ministry of Transport recently submitted for the observations of the Hammersmith Borough Council draft by-laws proposed to be made with regard to London County Council tramway cars running in the borough, in which the ordinary speed was fixed at 16 miles per hour, in conformity with the general practice throughout London. The Borough Council have replied that on several occasions they have expressed the view that the speed in London should not exceed 12 miles an hour, and that they still adhere to this opinion. Attention having been called to the danger at one of the London tramway termini, where persons waiting for cars have to stand in the middle of the road, sandwiched between motor lorries and other traffic, the Commissioner of Police replied that the question of the formation of queues at tramway termini had been considered on many occasions, but that no solution has yet been found for the difficulty. Mr. J. K. Bruce (traffic manager, London County Council Tramways), replying in an interview to criticisms that

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tramway stops are too numerous, said that generally there are about eight stops per mile, of which two are compulsory and six by request. The average length of stay at a request stop is seven seconds, so that, assuming that stops are made at every "by request" stopping place, the total stop time, excluding main traffic points, over a seven-mile route is less than five minutes. Actual checks show that the total stop time for a journey of this distance is between three and four minutes, as even at rush hours a considerable proportion of the optional stops are not required on all journeys. Mr. Bruce also pointed out that the speeds maintained on the London County Council tramways are very much higher than the speeds of any other city tramway in the United Kingdom, notwithstanding the greater density of tramway service in London, and the heavy and varied vehicular traffic along the tramway routes. Detailed observations show that, at any rate up to four miles, travelling by a direct tramcar is quicker than travel by any other means when a change of vehicle is made *en route*.

NEWCASTLE-ON-TYNE.

MOTORISTS AND TRAMWAY PASSENGERS: CORONER'S COMMENTS.

Strong comments on the behaviour of many motorists when passing tramway cars from which passengers are alighting were made by Mr. Alfred Appleby, the Newcastle Coroner, at an inquest on an aged woman who was struck by a motor car after she had alighted from a tramway car. It appears that the deceased had nearly reached the kerb when she was startled by a shout and turned in front of the motor car. It struck her very gently, but she fell and the front wheel passed over her. The Coroner, while advising the jury that in this case there did not appear to be any criminal negligence on the part of the motorist, emphasised the importance of motorists exercising the greatest possible care when passing tramway cars from which passengers were alighting. In some towns, he said, a by-law required that they should pull up. In going about Newcastle he saw a disregard on the part of many motorists to observe what he considered to be proper care in passing standing tramway cars. Indeed, he had been obliged, as an alighting passenger himself, to jump sharply on to the footpath to escape motor cars. The drivers appeared to imagine they could just sound their horn and that every citizen must jump out of the way. "That is by no means the case," he added. "I say very clearly and advisedly, that if motorists go on when passengers are alighting from tramway cars, they do so at their peril." In returning a verdict of accidental death and exonerating the motorist in this case, the jury associated themselves with the general remarks of the Coroner on the duty of motorists.

PORTSMOUTH.

FARE REVISION.

The working of the tramways under the revision of fares from May 3 to July 15 was considered recently at a special meeting of the Tramways Committee. The report showed a deficit of £4,421 for the period in comparison with a profit in the corresponding months of 1921 of £6,862. The passengers carried during the period aggregated 8,597,843, an increase of 1,331,430. It was decided to recommend the Council to rescind their previous resolution dealing with the fares and to give the committee authority to reconsider the matter.

SALFORD.

TROLLEY BOYS.

The Tramways Committee is dispensing with trolley boys. All that are suitable for work in other departments of the undertaking will be transferred, and no new boys will be engaged. A strong protest was made at a meeting of the Manchester and Salford Trades and Labour Council.

TWICKENHAM.

TRACK REPAIRING.

The Urban Council has declined to assent to a proposal of the London United Tramways, Limited, to use asphalt in place of wood for track repairing.

WEST BROMWICH.

PROPOSED CHANGE OF CONTROL.

The Corporation propose to take over the working of the tramways in 1924. Reconstructional work is contemplated at an estimated cost of £65,000.

YARMOUTH.

MANAGER'S POWERS.

The Tramways Committee, having received a letter from the National Union of General Workers as to the dismissal of a conductor by the tramways manager, and as to the disciplinary methods generally, approved the action of the manager, and further, gave him authority to engage and dismiss for incompetence or misconduct, any employee. Subsequently the powers of the manager were explained to a deputation from the Union.

PERSONAL.

Mr. A. E. Ford has been appointed acting manager of tramways by Auckland (N.Z.) City Council.

Mr. F. Gill, president-elect of the Institution of Electrical Engineers, has been visiting the United States.

Mr. Charles Stewart, sales and contracts manager of Messrs. Johnson and Phillips, Limited, has been appointed a director.

Councillor Harry Brooks, J.P., chairman of the Blackpool Tramways and Electricity Committee, has been invited to become the next Mayor of Blackpool.

Mr. Stanley, general manager of Kalgoorlie Electric Tramways, Limited, and his staff, were again warmly complimented upon their work by the chairman at the annual meeting.

Mr. John R. Struthers, assistant resident engineer at Dalmarnock station of the Glasgow Corporation electricity department, has been appointed chief assistant engineer of Belfast Corporation electricity department.

Mr. W. F. Roberts has joined the staff of Hadfields (Australia), Limited, Alexandria, N.S.W. Mr. Roberts designed the large gears used in connection with the electrification of the South African Rand mines.

Sir Eric Geddes has consented to be nominated as president of the Federation of British Industries, and his nomination will come before the Grand Council at the meeting in October, when it is anticipated that Sir Eric will be elected.

Messrs. W. B. Woodhouse and J. J. H. Stansfeld, managing director and secretary respectively, Yorkshire Electric Power Company, have been presented by the employees with gifts to commemorate the twenty-first anniversary of the company.

Presentation to Union Secretary.—The Cardiff branch of the Transport Workers' Union have made a presentation to their late secretary, Mr. A. J. Attwell, Mrs. Attwell, and Miss Iris. Attwell, B.A. Mr. R. L. Horsfield (tramways manager to the Cardiff Corporation) handed over the gifts on behalf of the branch.

SIR JOHN TIMPSON HONOURED.

A large and representative assembly of the townspeople of Portsmouth and Southampton (including the Mayor and Mayoress and Alderman Dunsford of the latter borough) gathered at the Town Hall, Portsmouth, on September 5, to do honour to Sir John Timpson, K.B.E., K.S.T. (Japan), J.P., and in recognition of his mayoralty extending over three years.

Sir John is president-elect of the Municipal Tramways Association, and in the absence of Alderman Richard Mayne, the president, that Association was represented by the general secretary, Mr J. Beckett. Sir John was presented with his portrait in oils, and Lady Timpson with a fine grand piano, both of which had been subscribed for by all classes in Portsmouth. The gathering was eloquent testimony of the popularity of the recipients. The portrait, which hangs in the Assembly Room of the Town Hall, was unveiled by Major-General the Rt. Hon. J. E. B. Seely, M.P., the Lord Lieutenant of Hampshire, who also made the presentation to Lady Timpson.

The local committee presented to Sir John a miniature of his portrait, also in oils, for his own home. In response, Sir John recounted his long connection with the public life of his native town.

CONTRACTS AND ORDERS.

Leyton Urban Council have placed a contract with Mr. Bertram Thomas for the supply of a tramway switchboard.

The British Thomson-Houston Company, Limited, are to supply a turbo-generator to Gravesend Corporation at £17,623.

Northern Ball Bearings, Limited., have received an order from the Swedish Railways for sufficient bearings to equip thirty coaches.

Northampton Corporation have ordered a lightweight tramcar top cover from the Brush Electrical Engineering Company, Limited, at £270.

Blackpool Tramways Committee have ordered from Walter Scott, Limited, 215 tons of tramway rails needed for the relaying of a track.

Preston Town Council have accepted the tender of an English electric company of £94,900 for the erection of a new generating station in the town.

Liverpool Tramways and Electricity Committee have accepted the tender of Messrs. J. Henshaw and Sons for the erection of a sub-station at Aintree.

Salford Tramways Committee have accepted a tender of £2,150 by the Brush Electrical Engineering Company for the construction of a low-built tramway-car, the design to be approved by the Ministry of Transport.

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Wallasey Corporation Tramways have accepted the tender of the Scholey Construction Company, Limited, for one type " W " R.W.B. (Lincoln) welding plant in order to carry out the Lincoln process of joint welding.

Electric Trucks.—Reuter's Trade Service states that the Victorian Railways invite tenders for three electric storage battery industrial trucks, capable of carrying 4,000 lb. at five miles an hour. Tenders must be received by November 29.

Liverpool Tramways Committee have requested Messrs. Scholey Construction Company, Limited, to put a second rail hardening machine into operation immediately. Up to date approximately 17 miles of track have been treated by the Sandberg " in situ " rail hardening process.

Stevens Petrol-Electric Vehicles, Limited, have secured a repeat order from the Cardiff City Tramways for six additional Stevens petrol-electric chassis with tyres for their new omnibus services. This order comes after eighteen months' experience of the Stevens chassis in omnibus service.

Spearing Boiler Company, Limited, have obtained a contract for two water-tube boilers, each of a normal evaporating capacity of 57,650 lb. per boiler, Ferguson superheaters, chain grate stokers, economisers, and forced and induced draught plant, for the Charing Cross, West End and City Electricity Supply Company, Limited.

Vulcan Motors, Limited, are to supply a tower wagon to Bexley Urban Council Joint Tramways Committee at £500, less £30 for the old chassis. The price of the new vehicle includes the chassis, a flat platform type body, and driver's cab, but as certain parts of the old vehicle are used the net cost of the new machine will be reduced to £425.

Salford Electricity Committee have accepted the following tenders—L.t. paper lead-covered cable, W. T. Glover and Company, Limited, Manchester (approximate), £1,889; 500 K.V.A. transformer, Metropolitan-Vickers Electrical Company, Limited, £505; switchgear, etc., for Agecroft power-station, Metropolitan-Vickers Electrical Company, Limited, £56,506.

Contract Tenders for Belgian State Railways.—According to the *Chronique des Travaux Publics* foreign firms tendering for contracts for the Belgian State Railways need no longer make a deposit, as hitherto, on tendering. They will be required to do so, however, within five days of the receipt of a notification from the Ministry informing them that their contract has been accepted.

Special Track Work for Glasgow.—After a long debate, Glasgow Town Council, by a majority of only two votes (33 against 31), accepted the offer of the United States Steel Products Company for special tramway track work. The price quoted was £15,000, or £3,000 below the lowest British offer. The Labour members took strong objection to accepting the offer, contending that the conditions of employment in America did not comply with the Glasgow Corporation's fair wages clause.

Durban Corporation.—The municipality of Durban recently invited tenders, to be presented at the Town Clerk's office by September 13, for 3,125 lb. No. 5 S.W.G. copper wire, with two lappings of asbestos and double cotton covered, suitable for tramcar field coils, and two miles " 00 " trolley wire. Owing to the somewhat limited time available, the invitation was probably of use only to firms who were in a position to notify their local agents by cable. Local representation was practically essential to a United Kingdom manufacturer desirous of securing the contract. A copy of the specification, tender form, etc., was available for inspection in Room 50a of the Department of Overseas Trade, 35 Old Queen Street, S.W.

PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given in italics.

APPLICATIONS FOR LETTERS PATENT.

The number of the patent is given in brackets.

Switch apparatus for tramways, etc. (21,393)—D. Arcani.
Motor vehicle construction (21,165)—A. Boothroyd and W. J. Turner.
Tramway switch boxes or ground levers (21,358)—C. R. Matthews and S. S. Wrightson.
Motor vehicles (21,144)—G. Spencer, Moulton and Company, Limited, and E. C. Ward.
Route indicators (21,917)—G. E. Bench.
Tramcars, etc. (21,796)—J. L. Burton and the English Electric Company, Limited.
Method of enabling road vehicles to run on railed tracks (21,630)—G. Lynch.

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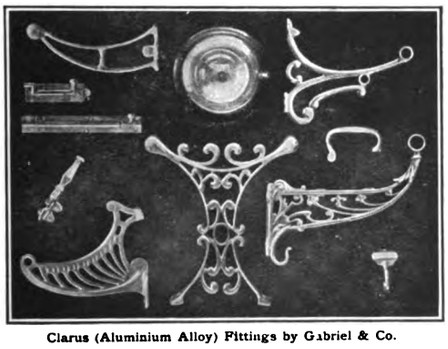

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Changeable tread rail for tramways (21,619)—W. J. Saunders.
Steering wheels for self-propelled vehicles (22,637)—British Thomson-Houston Company, Limited, H. W. H. Warren, and A. P. Young.
Electrically operated route indicators (22,055)—E. Lancaster.
Rail and road vehicles (22,069)—J. J. Mayrow.
Brake mechanism for motor vehicles (22,269)—J. A. Miller and W. D. Miller.
Transmission gear for motor vehicles (22,462)—J. Weller.
Machines for dressing rails (22,931)—T. Brooks and Woods-Gilbert Rail Remodelling Company, Limited.
Means for controlling brakes of front wheels of motor vehicles (23,107)—J. Colla.
Overhead runway rail systems (22,680)—J. Davies.
Liquid fuel consumption and distance indicators for motor vehicles (23,229)—J. Higginson.
Motor vehicles (23,210)—A. A. Holle.
Rail joints for tramways (23,104)—H. Littlewood.
Automatic electric sub-station systems (23,041)—Metropolitan-Vickers Electrical Company, Limited.
Motor vehicles (22,849)—A. E. Osborn.
Brakes for tramway vehicles (23,175)—G. H. Read and H. Read.
Motor vehicles (23,327)—H. B. Barwise.
Automatic steering apparatus (23,438)—British Thomson-Houston Company, Limited (*General Electric Company*).
Opening and closing mechanism for gate plugs of overhead rail systems (23,819)—J. Davies.
Device for use with steering gear of motor vehicles (23,258)—T. G. Dunn.
Trolleys of electric tramcars (23,711)—H. R. Garth.
Lubrication for axle boxes of vehicles (23,382)—W. Lofthouse.
Automatically controlling speed of motor vehicles (23,487)—National Manufacturing Company, J. G. Skinner, B. H. Tingle, and C. R. Townsend.
Braking motor vehicles (23,453)—F. Porsche.
Tramway tracks (23,726)—T. H. Rushton.
Motor vehicles (23,540)—G. W. Wadden.
Fare collection systems (23,343)—A. E. White (*Doldt Fare Handling Machine Company*).
Fare collecting apparatus (23,344)—A. E. White (*Doldt Fare Handling Machine Company*).
Steering mechanism for motor vehicles (23,465)—R. J. C. Tampier.

Specifications Published

1921

Trolley pole safety appliance for electric tramways, etc. (10,705—*182,584*)—P. M. De C. Ireland.
Steering gear for four-wheeled vehicles (10,941—*161,589*).—U. Pavesi.
Driving mechanism for motor vehicles (12,691—*163,299*)—G. M. Willis.
Steering gear for mechanically propelled vehicles (13,965—*182,634*)—H. Marles.
Brake mechanism for vehicles (14,500—*182,638*)—J. T. Brockhouse.
Transmission gear for motor propelled vehicles (15,508—*182,653*)—J. S. Wilkinson.
Rear axles with change-speed gear for motor vehicles (32,349—*172,317*)—G. H. Morin-Gauthier.
Mounting for trolley poles whereby the pole automatically descends should the trolley leave the line (9881—*182,878*)—V. Spagnuolo and M. Urbinati.
Joints of tramway and like rails (10,288—*182,891*)—S. Butler.
Apparatus for indicating or recording the stresses in the rails of tracks (17,337—*165,417*)—British Thomson-Houston Company, Limited.
Construction of axle for rail vehicle wheels (18,776—*183,034*)—A. E. Williams.
Means for superimposing a larger chassis frame on an existing chassis (12,152—*183,272*)—A. S. Dorsey.
Vehicle bodies and hoods therefor (17,522—*183,341*)—S. Gage and London General Omnibus Company, Limited.
Control of brakes in automobile vehicles (25,188—*183,385*)—L. Renault.
Variable speed gearing for motor road vehicles (9,012—*183,524*)—E. J. Wade and G. W. Jacobs.
Electrically propelled road vehicles (12,334—*183,596*)—R. Freeman and Railless, Limited.
Chairs for rails (12,571—*183,604*)—L. M. Blyth and J. C. Couper.
Electrical operation of switch points from the vehicles (12,993—*183,611*)—M. Loughridge.
Trolley collectors for electrically driven tramcars or road motor vehicles (27,622—*183,756*)—P. T. J. Estler, E. P. B. Estler, and H. P. C. Estler.
Steering gear for mechanically propelled vehicles (14,348—*183,961*)—Marles Steering Company, Limited, R. Bishop, and H. W. Egerton.
Devices for raising and lowering trolleys in systems of electric traction with overhead conductors (19,353—*184,038*)—R. Brooks, A. Priestley, and Metropolitan-Vickers Electrical Company, Limited.
Motor front guard for protection of life (21,430—*184,063*)—C. A. Stone.

1922

Brake mechanism for motor vehicles (9,290—*183,405*)—R. O. Harper.

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1921. WEEKS ENDED Aug. 13	Aug. 20	Aug. 27	Sept. 3		1922. WEEKS ENDED Aug. 12	Aug. 19	Aug. 26	Sept. 2		AGGREGATE. Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	4.251	4.002	3.995	3.903	...	4.244	4,068	4.150	3.788	...	13½	51.847	+ 844
Aberdeen Motor Buses	487	430	347	293	...	441	377	374	273	...	13½	4,686	– 732
Ayr Corporation	1.336	1,115	953	786	...	1,294	988	950	826	...	16	14,493	– 737
Barrow Corporation	878	1,049	919	915	...	693	695	654	681	...	22	14,127	– 6,200
Belfast City Tramways	12.031	12.496	12.059	11,962	...	11.891	11.767	11,700	12.061	...	22	258,496	– 21,411
Birkenhead Corporation	2.581	2.806	2,746	2,771	...	2.444	2.565	2.379	2.393	...	22	54,897	– 2,515
Birkenhead Motor 'Buses	998	793	685	724	...	994	1.092	830	843	...	22	18,216	+ 761
Birmingham Corporation	27,315	28.876	28,852	28,955	...	23,667	26.975	27.966	27,564	...	22	624,975	– 25,712
Birmingham Motor 'Buses	1.824	2.023	1.903	1,969	...	1,706	1,908	1.936	1.740	...	22	41,473	– 6,488
Blackburn Corporation	2,377	2.599	2,767	2,635	...	2.530	2,419	2.514	2,449	...	22½	55,793	+ 4,032
Bradford Corporation	13,659	15.186	13,955	13,882	...	13,110	13,942	14.058	13.853	...	23	315,253	+ 14,140
Brighton Corporation	3,687	3.708	3,606	3,397	...	4.030	3.520	3.442	3.170	...	22¾	60,511	– 163
Burnley Corporation	3.407	3.641	3,449	3,666	...	3,338	3,363	3.418	3.445	...	—	—	—
Burton-on-Trent Corporation ...	665	661	665	660	...	612	580	593	587	...	22	12,685	– 1,396
Bury Corporation	2,483	2,672	2,614	2.718	...	2.351	2,598	2.528	2.551	...	22¾	56,092	+ 588
Chatham and District	1,827	1,769	1,758	1,975	...	2.029	1,880	1.894	1,980	...	35	58,368	+ 95
Chesterfield Corporation	1,496	1.430	1,500	1,466	...	1,169	1,302	1,376	1,227	...	21	26.845	– 3,102
Derby Corporation	2,234	2,276	2.256	2.399	...	2.284	2,471	2.194	2,183	...	22	48,449	– 17
Dundee City	3,157	3,149	3.236	3.467	...	2,963	2.944	3,105	3,120	...	15¾	47,029	– 4,939
East Ham Corporation	2.016	2.110	1,987	2.053	...	2.125	2.037	2.124	2.096	...	22½	47,636	+ 645
Edinburgh Corporation	12.551	12.617	11,504	12.585	...	12.089	11,721	11,358	12.468	...	16	203,159	– 15,638
Edinburgh Motor 'Buses	339	3.600	3,182	3.416	...	3.568	3,653	3,506	3,246	...	16	60,456	– 3,142
Glasgow Corporation	43.087	45.426	43.305	46.528	...	40,566	41.614	41,238	44,277	...	13½	559,477	– 45,352
Glossop (Urban Elec. Supply Co.)...	239	261	237	234	...	230	224	217	217	...	35	7,888	– 194
Halifax Corporation	4.898	4,809	5.094	4,611	...	4,630	4,921	4,456	4.399	...	21½	96,533	+ 853
Halifax Motor 'Buses	60	51	62	57	...	122	104	86	101	...	21½	1,783	– 274
Halifax Railless Cars	78	74	59	64	...	27	67	57	33	...	21½	1,040	+ 643
Huddersfield Corporation	5,427	5,628	5,379	5,129	...	5,355	5.956	5,762	5,387	...	23	125,252	– 2,815
Ilford U.D. Council	1,455	1,495	1,462	1,513	...	1,417	1,398	1,461	1,412	...	22½	32,896	– 1,439
Ipswich Corporation	1.021	1.071	1,081	1,066	...	1,061	998	982	971	...	22	19,547	– 323
Isle of Thanet...	3,495	3,420	3,285	3,345	...	3.347	3,367	3.243	2,979	...	47½	52,541	– 1,788
Kilmarnock Corporation	339	370	373	380	...	294	318	323	335	...	15½	5,212	– 748
Leicester Corporation	6.646	7,193	7,055	7,213	...	6.298	7,359	7.358	7.434	...	35	256,955	– 36,004
Liverpool Corporation	29.817	30.885	30.243	30.544	...	29.603	30.171	29.761	29.608	...	35	1,029,208	+ 24,411
London County Council	97.200	98,820	99.270	99,269	...	92.356	90,948	93,490	94.507	...	21½	2,045,062	– 177,959
Maidstone Corporation	510	498	506	542	...	585	496	512	503	...	21½	11,023	+ 83
Manchester Corporation	36.548	39,244	38.229	38.496	...	32,517	34.573	35.590	34,735	...	22	788,216	– 88,679
Newcastle-on-Tyne Corporation ...	11.317	11,396	11,333	11.543	...	10,434	10.106	10.222	10,002	...	22	228,324	– 23,557
Nottingham Corporation	7.210	7.323	7,192	7.383	...	7,692	7,726	7,813	7,898	...	22	170,454	+ 35.046
Oldham Corporation	4.945	5,163	5.135	4,424	...	4,509	4,817	4,830	4.181	...	23	107,722	– 5,738
Preston Corporation	1,936	1,869	1.994	2,074	...	1,963	1,866	1,914	2,026	...	21½	40,067	– 2,241
Preston Motor 'Buses	...	...	...	...	...	144	134	140	152	...	21½	2,874	—
Reading Corporation	1.642	1,679	1,658	1,774	...	1,733	1,586	1,544	1,604	...	22	34,546	– 673
Reading Motor 'Buses	383	377	396	393	...	484	410	392	392	...	22	8,148	+ 105
Rotherham Corporation	2.529	2,498	2.564	2,541	...	1,942	2,165	2,165	2,140	...	21	44,850	– 1,361
St. Helens Corporation	1,899	1,927	1,993	1.866	...	1.701	1,621	1.686	1.569	...	22	34,680	– 5,933
Salford Corporation	10,727	11,089	10.773	12,046	...	8,672	9,816	9,499	9.820	...	22¾	226,766	– 22,743
Sheffield Corporation...	19,331	20,693	19,912	19,986	...	16.278	18,732	18,166	18.084	...	22¾	406,584	– 32,976
Southampton Corporation	3,452	3,388	3,505	3,460	...	3,753	3,543	3,530	3,362	...	22	70,795	+ 6,847
Southampton Motor 'Buses	92	91	92	94	...	101	105	109	103	...	22	2,214	– 2,419
Southend Corporation	4,713	4.469	4,408	...	...	4,732	4,345	4,409	...	...	21	61,678	– 4.135
South Shields Corporation	1,846	1,885	...	...	...	1,826	1,787	...	...	...	20	33,531	– 1,518
Sunderland Corporation	2,929	2,900	2,820	2,840	...	2.852	2.956	2,529	2,598	...	22	58,275	– 1,290
Swindon Corporation	447	437	446	442	...	403	428	402	393	...	21½	8,005	– 1,031
Tyneside Tramways and Tramroads	1,137	1,123	1,103	1,130	...	1,095	953	956	909	...	9	8,113	– 2,458
Wallasey Corporation	3,030	3,279	2,981	2,930	...	3.053	3,071	2,979	2,763	...	22½	60,604	– 4,527
Wallasey Motor 'Buses	289	254	276	194	...	336	290	316	227	...	22½	5,773	– 149
Walsall Corporation	1,611	1,785	1,678	1,665	...	1,551	1,409	1,522	1,404	...	22	34,137	– 3,351
Walsall Motor 'Buses	1,019	1,125	1.038	983	...	1,001	762	837	741	...	22	18,364	– 3,148
Walthamstow U.D. Council	2.099	2,135	2,052	2.193	...	1,999	1,966	2,093	1,920	...	22	43,655	– 6,480
Warrington Corporation	1,003	982	978	1,010	...	943	933	969	962	...	22	20,979	– 496
West Ham Corporation	5,842	5,920	5,830	5,907	...	5,860	5,431	5,618	5.712	...	21½	125,899	– 4,498
Wolverhampton Corporation ...	2,308	2,581	2,471	2,381	...	2.208	1,970	2,264	2.042	...	22	46,695	– 4,772
Wolverhampton Motor 'Buses ...	675	705	699	683	...	789	642	705	650	...	22	14,291	– 141

Underground Electric Railways Company of London, Limited.

NAME OF COMPANY.	1921. WEEKS ENDED Aug. 13	Aug. 20	Aug. 27	Sept. 3		1922. WEEKS ENDED Aug. 12	Aug. 19	Aug. 26	Sept. 2		AGGREGATE. Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Underground Rlys. & L.G.O. Co. ...	226,751	231,195	228,085	236,475	...	226,737	232,215	234,019	230,609	...	35	7,917,477	– 391,662
London and Suburban Traction ...	59,416	57,970	56.001	58.268	...	50,210	48,110	48.138	46,148	...	35	1,713,032	– 224,367

Colonial and Foreign Tramway Traffic Returns.

Companies Issuing Weekly Returns.

NAME OF COMPANY.		1921. WEEKS ENDED Aug. 13	Aug. 20	Aug. 27	Sept. 3		1922. WEEKS ENDED Aug. 12	Aug. 19	Aug. 26	Sept. 2		AGGREGATE. Wks.	1922.	Increase or Decrease.
		£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine		80,254	80,101	81,383	79,091	...	86,911	82,356	79,324	75,697	...	35	2,912,751	+ 140,937
Calcutta	Rs.	101,141	96,995	92,009	94,250	...	119,440	117,428	116,890	114,501	...	35	3,697,777	+ 1010,915
Madras...	Rs.	...	...	(2 weeks)	50,962	...	...	...	(2 weeks)	51,257	...	35	786,122	+ 147,826
Pernambuco	$	3,588	3,166	3,267	3,830	...	4,198	4,139	4,163	4,312	...	35½	124,741	– 11,809

Companies issuing Monthly Statements only.

		1921. Mar.	April	May	June	July	Aug.	1922. Mar.	April	May	June	July	Aug.	Wks.	AGGREGATE. 1922.	+ or –
		£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo		4,935	5,121	4,570	4,135	3,842	...	5,244	5,473	3,329	4,212	3,770	...	16	16,784	– 884
Brazilian Trac. Mlrs		13102000	13562000	14462000	14257000	15477000	...	15238000	15413000	16093000	16266000	16655000	...	30	109170000	+13,4940'0
Brisbane		46,300	47,750	...	...	48,850	...	51,300	48,700	...	...	49,470	...	30	341,700	+ 14,555
British Columbia	$	867,083	835.793	826,039	803,903	840,155	...	849,680	818,177	827,701	802,511	834,772	...	4	834,772	– 5,383
Buenos Ayres L'c'z		59,365	60,238	58,492	51,071	51,944	55,873	61.775	57.619	59.278	52,642	57,227	55,873	8	113,100	+ 5,283
Burma	Rs.	50,931	50,159	48,353	54.275	43,764	...	60.296	58.631	65.357	61,823	61.637	...	52	710,871	+ 106,221
Cape Town ...		...	27,662	27,407	25,038	25,571	...	29,930	28.657	28,006	24,638	26.046	...	—	—	—
Carthagena & H. ...		2.226	2,329	1,602	1,410	1,936	1,773	2,145	2.991	2,793	1,174	2,257	1,880	34	19,088	+ 1,096
Cordoba		21,717	...	...	23,129	23,616	...	25,382	...	...	26.622	27.118	...	17	104,133	+ 11,775
East India ...		4,168	4,560	4,392	4,494	4,591	4.513	4,446	4.065	3,960	3,640	3,859	4,069	4	4,069	– 444
Kalgoorlie... ...		2,485	2,398	2,362	2,308	...	...	2.390	2.538	2,636	2,437	...	...	26	14,214	+ 1,924
La Plata		3,403*	...	...	5.187	5,425	5.811	7,067	...	...	5.883	6,643	6,470	34	52,424	+ 13,296
Manila ...	$	298,317	279.534	293,873	310.559	305,126	...	284,576	286.044	273.218	291,434	291,093	...	30	2,045.639	– 69,613
Monte Video ...		48,925	46.189	46,579	42,960	42.411	44.672	51,158	47,960	48.074	44.298	48.672	46,463	43	466,926	+ 3,427
Para		22,189	22,289	22,705	22.833	22,605	...	22.238	23,061	23,651	23,942	23,862	...	35	183.962	+ 2,312
Port Elizabeth ...		...	7,082	6,304	6,180	6.515	...	7.851	6,892	6,713	6,412	6,623	...	—	—	—
Rangoon ...	Rs.	158,121	125,163	138,950	130,000	133,536	133,000	150,500	139,375	145,450	140,400	140,250	137,738	35	1,122,146	+ 60,100
Winnipeg ...	$	495,208	462,378	433,836	432,894	390,109	...	464,900	435,058	427,880	405,688	397,684	...	30	3,102,644	- 78,135

* Strike of Employees.

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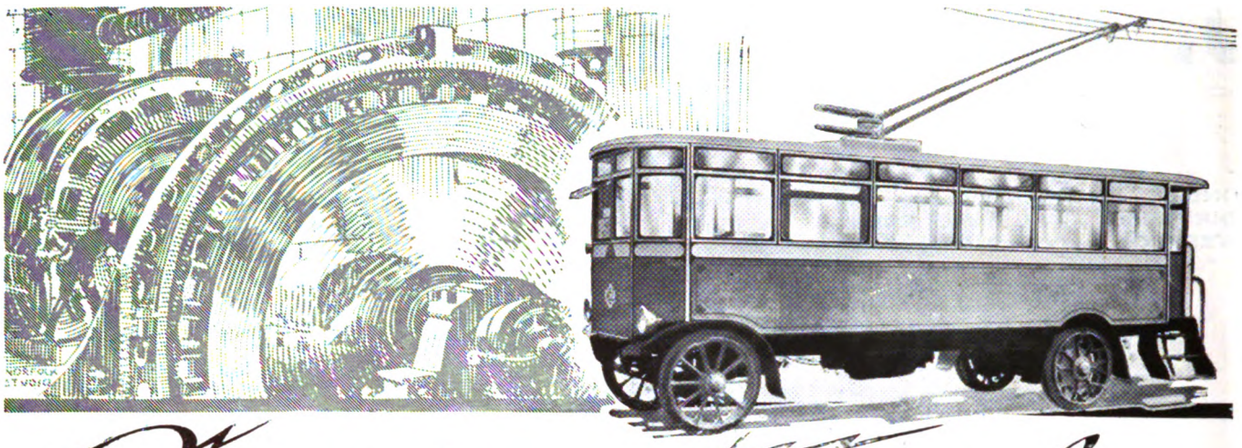

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WHERE the tramway ends continue with the current only. Use the open road—go further! Start a new activity, end a big Transport difficulty, and solve a big financial problem—all together! Cut down capital expenditure on Tramways—dispense with permanent way upkeep. Run a public service on the *Lines of Economy*. Begin a new Era of profitable traction. A.E.C.s establish a very efficient link-up service with outlying districts, at cheap Tramway fares. Know more about the A.E.C. method. Write us to-day.

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WALTHAMSTOW 23 - - - LONDON E 17

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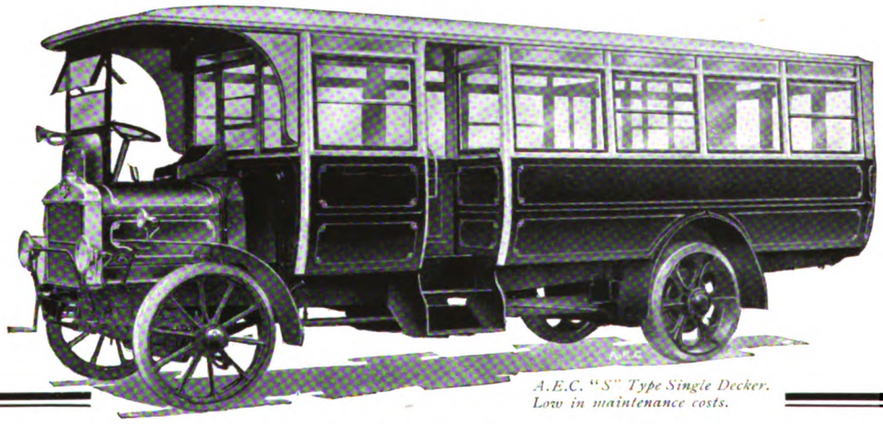
"Where the Tramway ends"



A.E.C. "S" Type Single Decker. Low in maintenance costs.

AEC REGD
COMMERCIAL MOTOR VEHICLES
Passenger: 28-57 Seating Capacity
Goods: 3, 4 and 5 Tonners

Reliability, Power & Speed

A.E.C.s are Reliable and Economical. They are powerful, silent, speedy, well sprung vehicles, sturdily built for hard work and endurance under heavy loads. Satisfied owners are constantly adding more A.E.C.s to their equipment—because they have proved A.E.C. superiority, and *know*.

For all Loads and Roads—choose A.E.C.s—You cannot do better.

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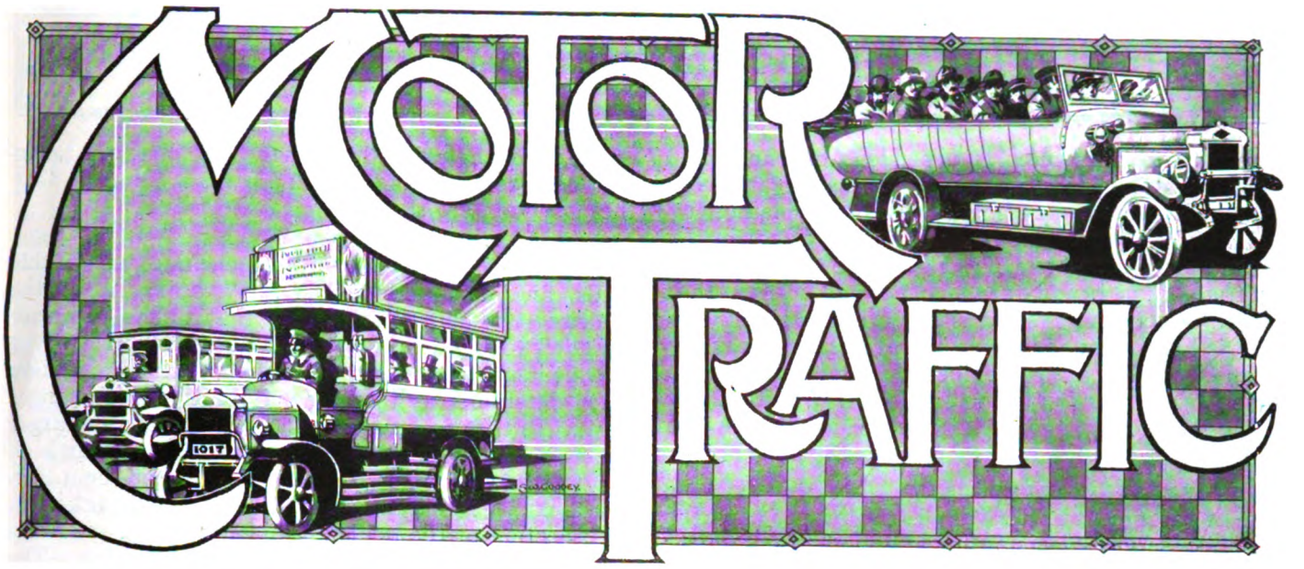

MOTOR TRAFFIC SECTION—SEVENTEENTH YEAR OF PUBLICATION.

MOTOR COACHES AND THE ROADS.

Important as it is that nothing shall be done which will in any way impede the development of the motor coach movement, it must be admitted that in certain districts damage is being done to the roads out of all proportion to the benefit conferred on the ratepayers by the presence of large motor coaches. In some districts where these vehicles are very popular, they constitute one of the main attractions of visitors to the locality. In such cases the question of road damage, if it cannot be wholly ignored, must be regarded as of secondary importance. A town depends largely for its prosperity on attracting business, and it will suffer in competition with other resorts if it deliberately muzzles an important attraction. On the other hand, there are small places where tourists do not stay to any extent, but which they like to visit. Large numbers of coaches make these places their objective. The local ratepayer benefits only to the extent of the trifling profit made by those who supply light refreshments. At the same time his roads, which are unfitted for heavy traffic, may suffer very seriously, and his consequent grievance is a real one. Moreover, in these more remote districts the use of narrow, winding and hilly roads by very long and wide vehicles cannot be altogether unaccompanied by danger and, at the best, such vehicles tend to block the roads, occupying so much space that even an ordinary car or cart has great difficulty in passing. To some extent the trouble is due to the existence of so many surplus Government vehicles. Coach proprietors have bought up heavy chassis at low prices and fitted large bodies upon them. Many of these chassis are unnecessarily cumbrous for the work, and are probably noisy, and therefore objectionable on that score also. The thing to avoid is the introduction of general restrictions by regulations intended to meet particular cases; and this can only be avoided if those interested in supplying and running motor coaches themselves adopt a reasonable attitude in recognition of the interests of those who have to pay for the roads which they use.

NEW BODIES ON OLD CHASSIS.

Another point which strikes the observer of motor coaches now on the road is that, in some instances, proprietors have spent money freely on good bodies, but have fitted them to inferior or unsuitable chassis. The case is more or less analogous to the saying about putting new wine into old bottles. If a chassis is clumsy, noisy, or unreliable, the complete vehicle cannot give real satisfaction, however much money may be spent on making the body showy and comfortable. Moreover, the life of the body will be found to depend very much on the quality of the chassis beneath it; and it is bad policy to spend money on an expensive body and then to use it under conditions which are bound to make depreciation very rapid. This is really another aspect of the curse of the surplus Government vehicle, the existence of which is not only hindering the renewed prosperity of the commercial vehicle industry by decreasing the demand for new vehicles, but is also in the process damaging the reputation of that industry and making for it a multitude of enemies among the public.

PROSPECTS OF REDUCED PRICES.

There has been a good deal of talk lately about reductions in the prices of motor vehicles. It is questionable, however, whether any substantial reductions are practicable in respect of chassis for commercial or public service work. The prices of these have already been cut down so that in many cases their sale represents almost no profit to the manufacturer. A manufacturer cannot go on selling at no profit for an indefinite period, and consequently, as costs are gradually reduced, the resulting savings must for the time being go to the manufacturer rather than to the buyer. Thus it is difficult to see that there is any adequate argument in favour of holding up orders in anticipation of early and considerable price reductions. At the same time, costs are undoubtedly coming down in respect both of wages and of materials. The process must be a more or less gradual one, because so many industries are inter-dependent. Thus, for instance, the price that the steel manufacturer must charge to

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MOTOR TRAFFIC

the motor manufacturer is dependent on the whole volume of his business, and must remain comparatively high until the shipbuilding and general engineering trades find more work to do. An improvement in the demand for the products of any section of the engineering trade thus reacts to the benefit of every other section. Such improvements are taking place, and the result is that manufacturers of private cars are in many instances anticipating savings by notifying price reductions. It is quite possible that an increased tendency in that direction will be noticeable at Olympia.

LIGHT PUBLIC SERVICE VEHICLES.

In the argument as to what is the proper capacity of public service vehicles for use under any given circumstances, the main contention in favour of the larger machines is invariably that, when they are used, the cost of operation per passenger mile is decreased, and consequently lower fares can be charged. A kindred point is that in order to provide carrying capacity for a given number of people, smaller road space in the aggregate is occupied if the units are large ones. While considering this subject, it is interesting to note the prevailing tendency as to price and size. Nowadays British firms are manufacturing chassis suitable to carry from 16 to 20 passengers in a coach or omnibus body at prices little if anything above 50 per cent. of the price generally charged for chassis suitable to take, say, a 36 or 40 seated body. Thus, if we have to deal with a given number of passengers, the capital investment involved by the employment of comparatively small machines is very little more than that involved by using larger machines. The repair bill on two of the small chassis will be heavier than that on the one larger chassis. The tyre bill also may be rather heavier. On the other hand, the traffic demand presumably fluctuates. If it is dependent, say, on weather or on the season of the year, then it is distinct economy to be able to garage one 20-seater, keeping the other on the road, and so dealing with the whole of the custom obtainable at a much lower figure than is involved if a 36-seater is used. The argument applies strongly at the beginning and end of the motor coach season, and also the height of the season, if the weather is indifferent. It applies far less strongly to regular omnibus services in towns. Incidentally, the owner of the smaller vehicles is likely to be far more popular with the local authorities responsible for road maintenance, and may therefore obtain running privileges which would be denied to his bulkier competitors.

MOTOR COACH ACCIDENTS.

The recent accidents to motor coaches in various parts of the country have again focussed attention on the danger that must necessarily follow the use of passenger carrying vehicles when run upon the present haphazard lines. There can be no question that in the interest of all who desire the success of this popular form of transport some system of intelligent control is long overdue. As matters stand, any person can run any machine, practically anywhere, without any regard to the suitability of the machine, the route to be covered, or the man who drives it. When these facts are taken into consideration the real cause for wonder is that the accidents are so few.

Briefly the accidents can be classed under three headings—those due to unsuitable machines, unsuitable roads, and unsuitable drivers. With regard to the vehicles it is a deplorable fact that unless they are intended to ply for hire in the London metropolitan area, it is nobody's business to inspect their condition or to determine as to their suitability for passenger work. In the case of the municipalities and the larger transport companies, the desire to maintain their high reputation for safe and sound service can be taken as a sufficient guarantee that every care is taken in the selection of the vehicles, and that close attention is given to all details which affect their service. The same considerations will also govern the selection of the operating staff. With the open field, however, and the practically unlimited number of war-worn chassis which have been available at prices calculated to tempt the speculator a large number of vehicles have been put into passenger services by people without experience or the necessary knowledge to ensure the safe working of such vehicles; and it is mainly in consequence of the unrestricted use of these machines that discredit is being brought upon the motor coach industry in many parts of the country.

It is obvious that there are difficulties in the way of drafting regulations which will adequately safeguard the public from the dangers of defective and unsuitable vehicles, and at the same time leave the experienced and skilful operator free to develop his business. As, however, the life and limb of the unsuspecting traveller is at stake, some such regulation is essential. At the present time the Ministry of Transport has no statutory powers even to inquire into road accidents and their causes, but, as stated in our issue of September 2, Mr. Neal, Parliamentary Secretary to the Ministry of Transport, in a letter to Mr. Walter Forest, M.P., says that the Government hopes to introduce a comprehensive Bill dealing with motor traffic, and points out that the question of the fitness of motor coaches and omnibuses is receiving the attention of a Committee. In the case of new vehicles of reliable makes the manufacturers' guarantee goes a long way to ensure the safety of the passenger, always providing the comparatively simple instructions for brake adjustment, oiling, etc., are complied with, but a very different problem is presented in the machines obtained at bargain prices from dealers in second-hand vehicles. In every such case where the machine is intended for passenger carrying service the presentation of a certificate from a responsible authority, certifying not only its freedom from all mechanical defects but its suitability for the routes it is proposed to cover should be made a condition of its being licensed. Providing sufficient care is taken in the selection of the inspectors, much of the element of danger which now exists would thus be eliminated.

Much has already been done on the main roads to fit them for motor traffic of all kinds providing it is reasonably handled, but it naturally follows that with the rapid development of the motor coach traffic and the country omnibus services, the accommodation

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MOTOR TRAFFIC

provided in many districts, both in regard to width of road as well as the quality of its surface, leave much to be desired. Time and the expenditure of large sums of money will effect great improvements, but the very nature of the terrain in some parts of the country will always mean that danger spots are left, while congestion is bound to occur at times at the approaches to all popular resorts. These facts clearly point to the absolute necessity that the drivers of these vehicles shall be men of approved ability, careful and cool headed. There can be no question that, given a vehicle in perfect condition, the safety of the passengers depends to a very considerable extent upon the action of the driver, even when the route of the vehicle is confined to main roads. The practice of using by-roads therefore should undoubtedly be discouraged if not entirely prohibited. Unfortunately there appears to be an increasing tendency to divert from main roads in various districts in order to enable the passengers to obtain views which would otherwise be missed. However laudable the intention on the part of the driver may be in such cases, the increased risk of accident on the narrow roads is apparent. The fact that serious accidents have occurred at points where large passenger carrying vehicles ought not to be allowed in the interest of public safety points clearly to the need of some definite form of control.

THE GARNER BUSVAN.

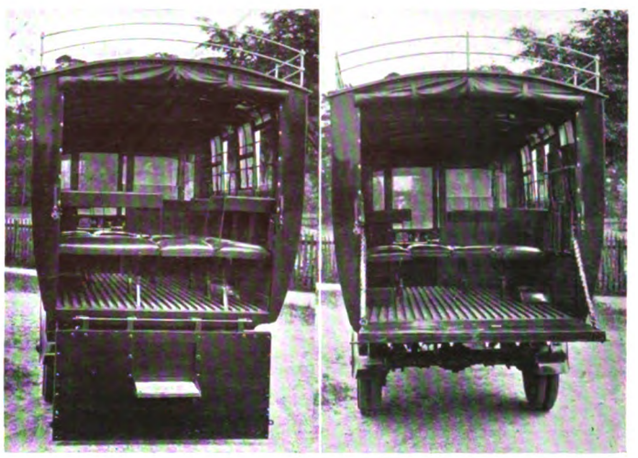
A Vehicle Suitable for Passengers and Goods.

The Garner busvan, manufactured by Henry Garner, Limited, of Moseley Motor Works, Birmingham, has been long enough in service to prove its utility and to demonstrate its economical claims. Operators' testimony has borne out the results of experiments carried out before the vehicle was placed on the market. In addition, the busvan body has the advantage of enabling its owner to avoid return empty mileage by devoting more accommodation to goods when passengers are not forthcoming. In this case the seats can be lifted up and folded against the windows, leaving a clear platform for loading purposes. From this point of view the busvan should have an interest for tramway and omnibus undertakings that have developed parcels services. As such undertakings are likely to

The Garner Busvan as a Passenger Vehicle.

have their own preferences in the matter of chassis, it is important to mention that Messrs. Garner, Limited, entertain orders for supplying the body separately.

Public service enterprises, rural carriers, hotels, and estate managers who have transport duties to attend to can each find something of interest in a vehicle which is claimed to be the only one built to carry passengers or goods without adding to or removing equipment. From the point of view of efficient and cheap running the manufacturers have made an excellent choice in the use of their No. 15 chassis, of 30-40 cwt. capacity. It has a four-cylinder 30 H.P. engine, which enables the steepest hills to be negotiated. There is a three-speed gear box and double reduction axle. As a standard fitting solid tyres are fitted, single in front and double at the rear, but pneumatics can be fitted at extra charge.



Views of Interior Showing Arrangement for All Passenger and for Part Passenger and Part Goods.

The carrying capacity is 19 passengers inside and one seated by the side of the driver, or 30 cwt. of goods. Another alternative is any proportion of both, a convenience which is rendered possible by the features that combine to make the body unique. General dimensions are—total length of vehicle, 18 ft.; length of body from dashboard, 14 ft. 8 in.; width of body, 6 ft. 1 in.; height from ground, 8 ft. 7 in.; height of floor from ground, 35 in. Any or all of the five rows of seats may be instantly folded to accommodate goods, or to provide a gangway without taking away or adding any equipment. Each seat is arranged to fold and hinge upwards when carrying goods, also to protect the windows. At an extra charge a detachable partition is provided to divide the vehicle when carrying goods and passengers. Passengers enter at the driver's cab on the near side, and at the rear of the driver a glass window shuts him off from the main interior. The driver has access to his seat from the off side. In width and leg room the seats are equal to the accommodation provided in tramcars and ordinary omnibuses, and each row has a full set of upholstered cushions.

On each side of the car there are five windows of non-inflammable transparent material, arranged to draw up into the roof; they are weather-tight, unbreakable, and free from rattle. When the windows are closed ventilation is obtained by a device at the top of each window. The loading of goods is accomplished by an entrance at the rear, where there is a hinged tailboard, the space between the latter and the roof being fitted with a roll-up curtain divided into two sections, each having a celluloid window. In the tailboard there is a sunken step, which affords an additional entrance to the interior. Luggage rails are fitted to the roof, and a detachable folding ladder is carried under the body.

PARIS MOTOR EXHIBITION.

October 4 to 15 is the date of the exhibition of all types of motor vehicles to be held in Paris. One thousand firms have entered exhibits, ranging from private cars and motor cycles to commercial vehicles and public utility machines. On account of the large number of entries two additional buildings are to be erected on the opposite side of the Seine to the Grand Palais. A great part of the new structures will be devoted to commercial vehicles, and each stand will have access to open-air sites upon which lorries, etc., can be placed and demonstrations given of labour-saving appliances.

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MOTOR TRAFFIC

NEW WAR SERVICE CHASSIS.

30-CWT. PNEUMATIC-TYRED LORRY.

The War Office Mechanical Transport Advisory Board have issued their specification for a 30-cwt. pneumatic-tyred lorry, and orders have been placed with several firms for a number of the vehicles. At present it is not proposed to grant a subsidy for commercial use, as was the case with the 3-4 ton lorry, but it is hoped that the new type will become popular with private users, thus providing a large number available in case of national emergency.

The specification provides for an internal combustion four-cylinder engine using commercial petroleum spirit, minimum bore 100 mm., minimum R.A.C. rating 24 H.P., maintained for not less than three hours at a speed equivalent to 22 miles per hour road speed even when using inferior fuel. Engine not to be under driver's seat.

Approved high tension magneto, preferably as standardised in British Engineering Standards Association's Report No. 80. Whatever type employed it should be interchangeable with the standard. Starting handle preferably carried on crank case extension, with locking device to keep it vertically above centre when not in use.

Petrol consumption to be not more than 40 gross ton-miles at ordinary speeds. Petrol tank capacity not less than 15 gallons. Vehicle to be capable of travelling 200 miles fully loaded on its tank and spare petrol supply contained in two or more 2-gallon tins in special rack.

Vehicle to be capable, when fully loaded, of 30 miles per hour for one mile on level and good surface, and of maintaining 22 miles per hour for two hours. Able to climb average gradient of 1 in 10 fully loaded at 8 miles per hour. At speed trials governor gear may be removed.

Detachable steel disc or steel wheels with detachable rims or flanges. Provision for non-skids. For beaded edge tyres all standard sizes as in Engineering Standards Association's Report No. 70. Pneumatic, of same size, not less than 36 in. diameter, of ample section. Large singles preferred, but twin tyres may be accepted for back wheels. Tyre pump power-driven, capable of pumping one tyre to full pressure in five minutes.

Cooling system capable of efficient working under all conditions, or of simple modification to be effected in tropical climate. Circulation all pump, and workable by thermo-syphon if pump fails.

Clutch to be plain cone or single disc. Vehicle to climb hard-surfaced gradient of 1 in 4 with full load. Able to stop and re-start on a gradient of 1 in 5, forward and reverse. Bottom speed reduction of 35 : 1. Desirable ratio between top and bottom gears about 5 : 1. Reverse gear preferably lower than bottom. Four speeds and one reverse.

Final transmission by live axle, preferably fully enclosed. Straight tooth bevel or worm drive. Double helical drive not accepted. Turning circle 45 ft. maximum outside diameter, preferably less. Load of 30 cwt., plus equivalent of body weighing 10 cwt., plus driver, passenger, fuel, oil, water, and full equipment.

Chassis weight not more than 29 cwt. Minimum ground clearance 10½ inches. Engine and gear box three-point suspended. Maximum overall width 7 ft., wheelbase 12 ft., track 6 ft. 6 in., with minimum of 4 ft. 6 in. Vehicle to be able to travel on hard bottom at slow speed through still water 18 in. deep. Springing to give range of 4 in. up and 3 in. down from fully loaded standing position. All springs to stand repeated deflection of 3 in. beyond the normal when fully loaded. Hand and foot brakes, each capable of stopping and holding the vehicle, fully loaded, on gradient of 1 in 5.

Oil lubrication desired throughout chassis in preference to grease, with wick feed lubrication wherever possible. Cape cart hood or light canopy to protect driver, and to be separate from body, with at least one inch clear between canopy and body. Seat to carry two men on driver's left.

The vehicles will be subjected to a variety of tests, both empty and fully loaded.

SCOTTISH MOTOR EXHIBITION.

Mr. D. A. Fairley, secretary Scottish Motor Trade Association, has notified the Glasgow Corporation that the association are prepared to negotiate for the Kelvin Hall from January 26 to February 3 inclusive for the twenty-first annual Scottish motor exhibition. The Kelvin Hall Committee of the Corporation recommend granting the use of the hall for the sum of £1,850.

THE HICKMAN COACH-OMNIBUS.

NEW DESIGN FOR ALL-WEATHER COACH.

The uncertain character of the weather which has been so pronounced this summer has directed the attention of motor coach proprietors most seriously to the problem of the convertible coach. It is felt that in order to retain the continuous support of the public every effort should be made to ensure the comfort of the passenger under all climatic conditions.

The photographic reproductions here given illustrate the latest attempt to solve the problem of an all-weather body of large seating capacity by the Hickman Body Building Company, Limited, of 8 Grove Road, Balham, S.W.12. The directors of this firm have previously devoted their time mainly to the production of light-weight omnibus bodies, specially designed for the most severe service conditions, but owing to the demand for vehicles that can be used either fully open or entirely closed, they have now produced a new type of body which appears to merit considerable attention.

In evolving this type of body the builders inform us that they have endeavoured to eliminate all moving parts that were not essential to the object they had in view, as by experience they had found that however satisfactory movable fitments may be when new, comparatively short service under normal working conditions develop troubles and difficulties which often prove both costly and tiresome to remove.

The design of the body is strictly on the best coach lines, from the flush-sided scuttle dash to the well-rounded rear and top back corners. The full coach doors with frameless drop windows are hung on either side of the driver's screen, which has a substantial contraction to reduce the width of the near side door when open for the entrance or egress of passengers.

The proportions between the depth of panel, windows, and dome of the roof are in good taste and the elbow line has an easy rise round the back of the body, while an emergency door with safety bar and indicating lever "to open" is fitted at the centre of the rear.

The driver's wind screen is arranged so that the driver's vision is uninterrupted when the screen is either open or closed, and the lower sight line permits a view of the front ends of the wings.

The interior of the body is trimmed in blue antique leather on coach lines for the comfort of passengers, the spring cushions being unusually long and wide, and the fluted back squabs of ample height. Trimmed elbow rails are also fitted—these being a standard feature of all Hickman bodies.

All side windows are in Honduras mahogany frames and are made to drop on Hickmam rattle-proof compensating fittings (patent applied for), which, from the point of view of low cost of maintenance, should prove attractive to operating concerns.

The arrangement of the roof (for which the builders are making application for a patent) is naturally the most interesting feature in the body. The body closed has a roof which in appearance and in effect is a fixed roof made of V-jointed matching and covered with canvas. This roof, however, is laid upon a light framework suitably strengthened, which is easily removable in two sections. When this roof is off the remaining structure comprises a light hoop stick across each pair of pillars and two light longitudinal reinforced members, which extend from the back section to the driver's screen. Upon this framing is fitted a khaki duck cover, fixed with straps to permit of any necessary adjustment due to shrinkage of the material. When not required for use this cover is rolled back and carried, ready for emergency use, on the back section of the body.

The special advantages claimed for the arrangement described above is that a completely weather-proof omnibus is provided for the winter, and a completely open coach for summer use, and attention is directed to the fact that the body is open from the driver's screen to within 18 inches of the extreme back of the body all side windows drop, and the wind screen opens in either direction as may be desired.

The painting scheme carried out by the builders, to the order of Brown's Motor Company, of Tunstall, is also interesting—the body is in white enamel with black mouldings, the chassis and wings are black, and the rear panel only bears the name of the proprietors, together with the coach name, 'Swan Duke," in script lettering. As will be seen from the illustrations, a most pleasing appearance has been obtained; in fact, it is not too much to say that elegance and utility have been most aptly combined.

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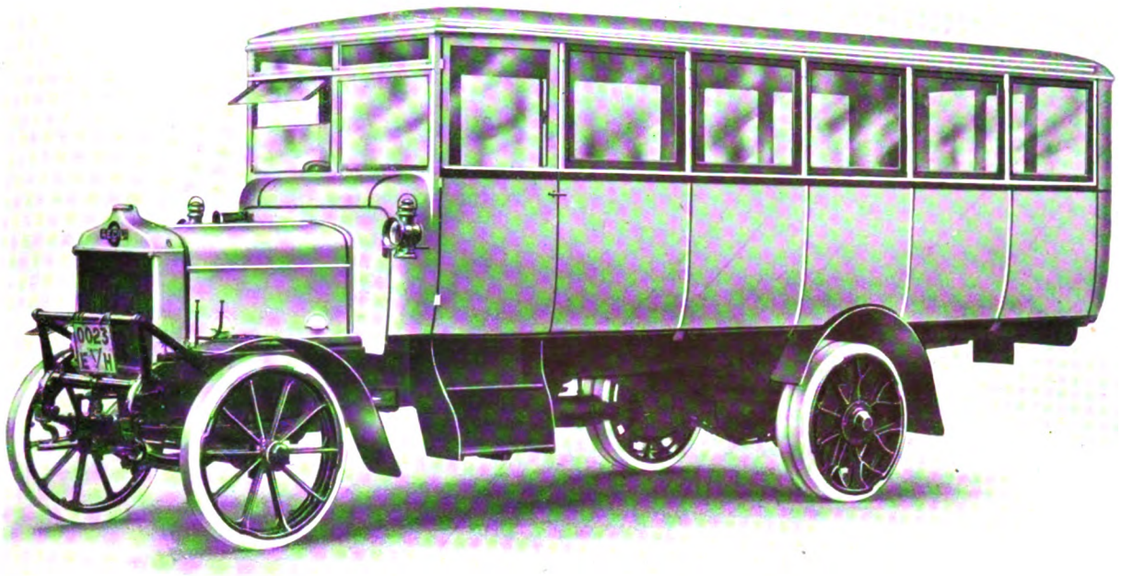
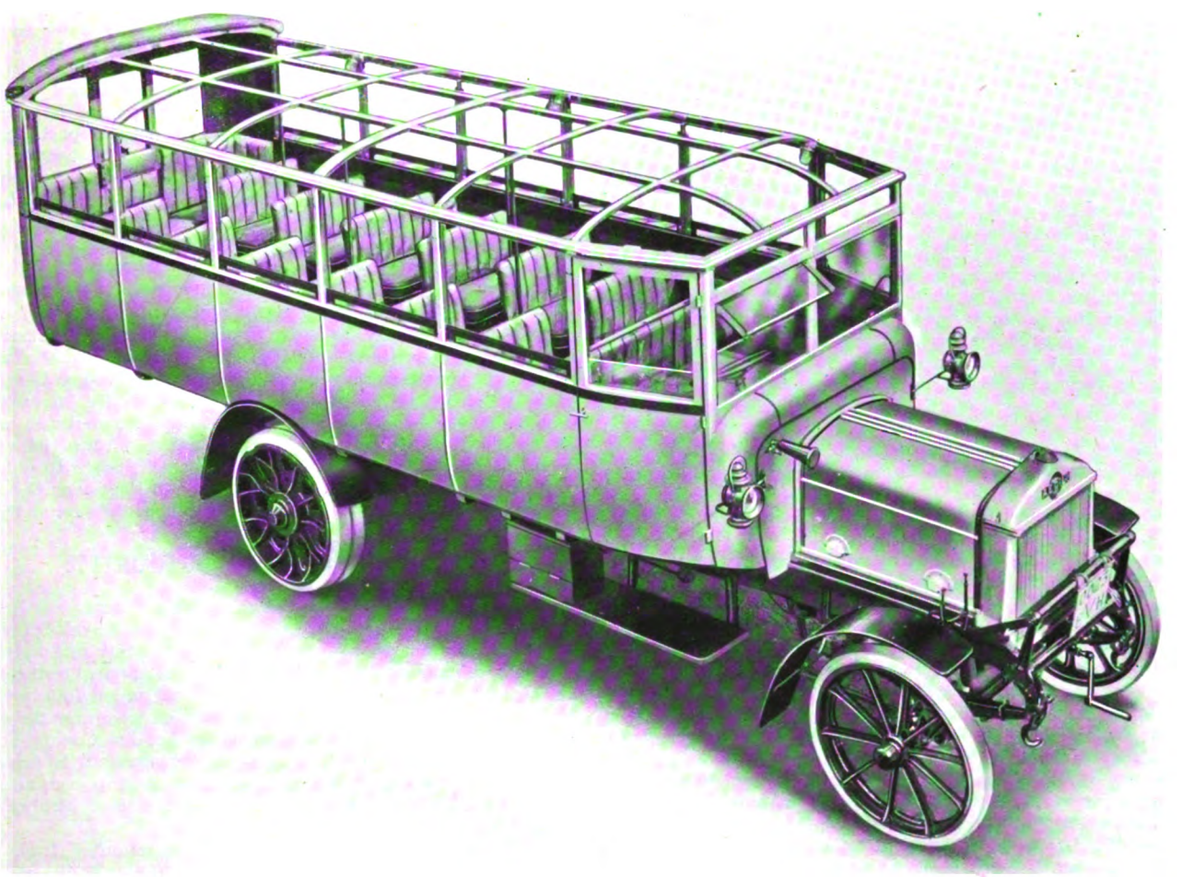
MOTOR TRAFFIC



The Hickman Coach-Omnibus, Closed for Winter Service.



The Hickman Coach-Omnibus, Open for Summer Service.

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MOTOR TRAFFIC

A SUGGESTION FOR MOTOR VEHICLE TAXATION.

By E. H. Rayner, M.I.E.E., M.Inst.T.
(*General Manager and Engineer, Hull Corporation Tramways*).

As a sequel to my article in your issue of August 24, I would like to put forward the following suggestion as a simple, effective, and equitable method of taxation for motor vehicles. I suggest that, apart from a nominal registration tax, there should be a petrol tax more nearly approximating a fair distribution of the tax than any other form of obtaining payment in proportion to the actual use made of the roads by the user.

I am aware that certain classes of vehicle will be favoured above other classes, principally the commercial vehicle, but as all taxation up to the present time has been framed to give very preferential treatment to this class of vehicle, this cannot be urged as a serious fault, assuming that the conclusions of my previous remarks are agreed to that the user should pay for the roads in proportion to the use he makes of the roads. Certain industries use petrol or benzol for trade purposes, but it is a simple matter to arrange for exemption in these cases.

The method of applying and collecting the tax I suggest should be as follows—Licences to purchase motor spirit could be issued in books of 25, 50 and 100, or any suitable number. These licences would be of various denominations from half-gallon to 100 gallons, to suit each type of purchaser. The books, coupons, or licences would be of different colours for each denomination, and on sale at all post-offices.

In operation it would mean that a licence for the amount of motor spirit purchased would have to be given by the purchaser to the retailer, and the retailer would have to produce the licences so obtained in order to obtain a certificate for an equivalent amount to be purchased in bulk. I do not see that there would be any hardship or inconvenience in this method. The retailer would obviously keep a few books of licences to accommodate the purchaser who had omitted to get licences for himself.

The collection would entail no additional staff and very little additional labour, as in the post-office staff the Government have a complete organisation to their hand. It is cheap, simple, and effective—all this, provided the principle of equity is accepted.

SCARBOROUGH CAR LICENCES.

The Scarborough Tramways Company some weeks ago put on the streets a service of motor vehicles, in competition with longer established services. The Corporation, it is understood, considered that Scarborough was already sufficiently provided with means of transport, and on that ground declined to grant licences.

The dispute came to an issue on August 25, when the local magistrates had before them a number of summonses issued by the chief constable of Scarborough against the tramways company and Mr. Hugh Seaton, the manager. These summonses alleged that on a number of days the defendants allowed hackney carriages belonging to them to ply for hire without having licences. A police constable gave evidence as to the facts leading to the issue of the summonses.

It appeared that the system pursued by the company was to advertise tours in the town and district on certain definite routes, and the tickets were issued at booking offices for these routes. The conductors had instructions to pick up only at certain specified places passengers who had tickets.

Alderman Willey, for the defence, said that application had been made to the Town Council for licences for the vehicles, but these had been refused. He contended that such a refusal had not been made by the local authority in the judicial and fair-minded exercise of their duties, and that the decision was *ultra vires*. As licences for the vehicles as hackney carriages had not been granted, the company had, under legal advice, adopted the system of issuing tickets at offices and only accepted persons who had tickets.

At the moment of going to press the unlicensed vehicles are still running in the town, and as a consequence the dispute between the company and the Corporation has taken on a new phase. By an arrangement with the Entertainment Committee of the Corporation it has been the practice for motor vehicles to take their passengers over the Marine Drive, paying at the rate of one penny per passenger. This toll, however, has not been collected at the time of passing the entrance to the drive, the collector receiving a slip giving the number of passengers each trip and payment being made at stated intervals. It has now been reported to the committee that a sum of over £200 is owing by the company for these tolls, which Mr. Seaton refuses to pay until his vehicles are licensed. The Corporation have therefore decided to demand the full toll of twopence from each individual passenger before permitting them to enter the drive.

ROAD VEHICLE REGULATION.

Attitude of the County Councils Association.

On the recommendation of a sub-committee the County Councils Association have expressed the following conclusions regarding the report of the Departmental Committee on the Taxation and Regulation of Road Vehicles—

Manufacturers and Classification.

There does not appear to be any objection to the proposed new classification of mechanically-propelled vehicles. They are not, however, satisfied that any adequate and ready method exists for ensuring that, on applications for licences, vehicles are properly described according to such classification, and they are therefore of opinion that a statutory obligation should be imposed upon the manufacturers to issue with every new vehicle turned out from their works a declaration containing a full description (construction, design, weight, etc.) of the vehicle, and a statement as to its proper classification. There should be a suitable penalty for a false declaration.

Weights and Speeds.

The maximum weights proposed to be permitted *without notification* in the case of heavy indivisible loads carried by trailers are too high.

The power proposed to be conferred upon the Minister of Transport to authorise a greater speed than 16 miles an hour for heavy motor cars in certain cases should be subject to a definite limit, and further consideration should be given to the extent of that limit.

As at present advised, the sub-committee have no objection to offer to the proposals contained in the appendix to the Departmental Committee's report in regard to the construction, design, weight, and speeds of mechanically-propelled vehicles.

Powers of the Minister of Transport.

The sub-committee note that, in certain cases, the report of the Departmental Committee contains recommendations as to the desirability of the Minister of Transport being empowered to vary, by regulations, the limitations laid down in the report, and they therefore desire to draw attention to the method by which it is proposed that such regulations should be sanctioned, namely, that they should be laid before each House of Parliament and be liable to annulment in the event of an address being presented against them. Insistence is also laid on the view, previously expressed by the Association, that Orders in Council and regulations laid before Parliament should depend for sanction upon both Houses.

Three Years' Postponement Suggested.

The sub-committee are in entire agreement with the reservation which they understand to have been expressed by the late Sir Harcourt Clare (the representative of the Association on the Departmental Committee) in regard to the proposals for increased axle weights and speeds for heavy motor cars and locomotives, namely, that such proposals should not come into force for a period of three years in consequence of the unsuitable condition (with a few exceptions) of the highways of the country and the financial inability of highway authorities to undertake the necessary reconstruction.

LONDON TRAFFIC AUTHORITY.

The City Corporation's Views.

The statement of evidence presented to the Royal Commission on the Government of Greater London by the City of London Corporation, announces that the Corporation "is opposed to the control of transport being placed in the hands of the London County Council or any other central authority which may be set up for the general government of London. So long as the London County Council, or any other central authority to be constituted, is financially interested as the owner of a transport service in its own area, it is obviously undesirable that it should also have the control of traffic which extends to its competitors.

"The Corporation considers that the question of traffic is so important and far-reaching in its effects as to require the undivided attention of a special authority, whose powers and duties should extend to a much larger area than could be contemplated for adoption for the general purposes of local government."

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MOTOR TRAFFIC

OMNIBUS SERVICES.

ABERDARE.—Mountain Ash Council have decided, in view of the financial conditions, not to entertain a suggestion by Aberdare Council that the two bodies should institute an omnibus service.

BIRKENHEAD.—The Tramways Committee have recommended that in the next Parliamentary Bill powers should be obtained to form and control queues of passengers for the tramcars and omnibuses.

BRIDGNORTH.—The Council have refused to permit Wolverhampton Corporation to run omnibuses in their district.

BRISTOL.—The Watch Committee have decided that omnibuses licensed in the city is adequate to meet the needs of the public.

CARDIFF.—A report by Mr. R. L. Horsfield, general manager, stated that the department had been operating omnibuses for fifteen months, and had lost approximately £300 a month. The period had been one of very great trade depression, but there were better prospects ahead. On one route the receipts per mile had risen 8d., while the working expenses were falling. On the Moorland route the service, which was instituted against his advice, resulted in a loss of £1,500 in eight weeks. It was proposed to place the six new vehicles recently ordered from Messrs. Stevens Petrol-Electric Vehicles, Limited, on the Whitchurch route.

DEVONSHIRE.—Torquay Tramways Company have acquired the undertaking of the Devon General Omnibus and Touring Company at Exeter. The combined services are being developed. At Exeter Mr. D. Campbell, formerly traffic superintendent of the Oxford Motor Services, is in charge, and Mr. H. J. Nisbett, engineer and manager of the tramways, retains control in the latter district.

GREENOCK.—A sub-committee of the Corporation have recommended the running of omnibuses in the upper part of the town.

HUDDERSFIELD.—Following a demonstration of single-deck omnibuses, the Tramways Committee have given an order to Guy Motors, Limited, for two 2-ton machines with enclosed front entrance. Other points considered were springing and economical running.

LEEDS-YORK.—This long-distance service is now in operation between the Killingbeck (Leeds) tramways terminus and Dringhouses, on the outskirts of York. The headquarters of the undertaking are at Tadcaster. From Leeds to Tadcaster the single fare is 1s. 2d., the return being 2s. A single ticket from Tadcaster to York is 1s. 2d., and the return 2s. Adding 1s. for the tramway fares in Leeds, the total return fare is 11½d. less than the railway fare.

MAIDSTONE.—The Town Council have adopted a recommendation by the Tramways Committee to promote a Bill for powers to run omnibuses or railless trolley cars within the borough boundaries. The powers are particularly required in the North Ward.

MANCHESTER.—Tenders have been received by the Tramways Committee for the supply of a single-deck petrol omnibus to seat 20 to 24 passengers, and able to be entirely operated by one man. If it proves satisfactory, this type will be used on light services. Licences are being applied for to run omnibuses to Reddish, and to extend the Sale service.

MOTOR VEHICLES FOR MUNICIPALITIES.

BILLINGE URBAN COUNCIL are obtaining a 2-ton lorry.

ILKLEY URBAN COUNCIL are buying a fire engine at £1,800.

WARRINGTON CORPORATION have purchased a Fiat 10-15 car.

SEVENOAKS COUNCIL propose to obtain a 5-ton Sentinel wagon.

CHATHAM COUNCIL are recommended to purchase a steam wagon.

MALDON COUNCIL have agreed to purchase a Dennis fire engine at £1,200.

DERBY COUNCIL have ordered a 1-ton tipping lorry for experiment in refuse collection.

HALIFAX WATCH COMMITTEE propose to invite tenders for the supply of a motor fire engine.

MACCLESFIELD COUNCIL propose to obtain two petrol-electric wagons of 2-tons capacity for house refuse collection.

TRURO CITY COUNCIL are to consider the desirability of providing a motor fire engine for the benefit of outlying districts.

ILFORD GENERAL PURPOSES COMMITTEE have again recommended the purchase for official use of a landaulette motor car at a cost not exceeding £875.

HALIFAX HAULAGE COMMITTEE have purchased a Straker-Squire 5-ton three-way hydraulic tipping wagon, with specially fitted body, at a cost of £1,317 10s.

ENFIELD SANITARY INSPECTOR, in his annual report, says the 2½-ton Edison electric vehicle has proved a very great acquisition for the removal of house refuse. Formerly it took three horses and carts, but by the use of the electric vehicle an efficiency and control has been secured not possible with horses alone.

THE METROPOLITAN BOROUGHS STANDING JOINT COMMITTEE have induced the Ministry of Transport to convene a conference to discuss with the joint committee and the London County Council the refusal of the latter body to register a vehicle used on road work at a reduced licence fee, although the same vehicle used for the same purpose by contractors would be registered at the lower fee.

BLACKPOOL CORPORATION'S cleansing superintendent reports that the Karrier combined sweeping and collecting machine has carried out very valuable work since its acquisition in February, 1921. The Laffly motor sweeper also continues to render invaluable aid. There are also six 2-ton electric vehicles for refuse removal and two electrically-propelled sprinklers. In the winter the latter vehicles are converted into lorries for refuse removal

THE KENDRICK ELECTRO-MAGNETIC INSPECTION LAMP.

The accompanying illustration exemplifies one of the many occasions when the motorist who is equipped with a "Kendrick" lamp realises its utility. This useful accessory has been on the market since November last, and, as is proved by the number of repeat orders from stockists, garage proprietors, and exporters, is an established success. It has all the usual advantages of an all-British accessory, namely, good workmanship and design, first-class appearance, robust construction, and economical efficiency, and is altogether an "engineering production" in the fullest sense of the word. Briefly it consists of a lamp-holder (complete with wire guard, bulb and length of flexible) mounted on an electro-magnetic

Tyre Changing at Night by the Aid of Kendrick Lamp.

base, which adheres strongly to any iron or steel surface, leaving the operative's hands free, thus preventing the possibility of breakage, and ensuring efficient illumination of the work to be carried out without obstructing the worker. The motor car type is made to suit 4, 6 or 12-volt accumulators, and can be immediately attached to any car lighting set, direct to the battery or to the side lamps themselves. The makers (the Neale Magnet Construction Company, 7 Suffolk Street, Pall Mall East, S.W.1) also make a high voltage lamp for any circuit between 100-250 volts for factories and other industrial concerns, and a further model, approved by the Home Office, with special insulating and earthing arrangements to comply with the Factory Acts. The makers anticipate a big future for this well-made and efficient accessory, as it can be used in any position. It should be found most useful in tramway depots, for pit work, and other purposes where light is needed in confined positions. The lamp will be exhibited at the motor show at the White City in November next on Stand No. 111.

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MOTOR TRAFFIC

MOTOR TRAFFIC NOTES.

A Charge for Pump Sites.—Sydney (N.S.W.) Municipal Council propose to make a charge of £5 per annum for the privilege of erecting petrol pumps on the footways.

Islington Municipal Garage.—The Mayor of Islington opened the new garage of the mechanical vehicles of Islington Borough Council on September 9. There was a parade of the vehicles.

Colwyn Bay Council and Omnibuses.—The Llandudno Coaching Company have appealed to the Ministry of Transport against the refusal of Colwyn Bay Council to grant licences for double-deck omnibuses.

To Meet Railway Competition.—The Motor Haulage Trade Committee of the Nottingham Chamber of Commerce are lowering haulage charges with a view to meeting the competition caused by the reduction of railway charges.

Belgian Automobile Show.—This exhibition will be held at Brussels from January 13 to 24, 1923. The regulations for exhibitors can be obtained from C.S. des Constructeurs d'Automobiles et de Cycles de Belgique, 80 Rue de Namur, Bruxelles.

Petrol Pumps in Nottingham Streets.—The Nottingham Watch Committee have refused applications to place pumps on the kerb in streets where the machines might obstruct pedestrians. Side streets, the committee suggest, should be utilised.

Middlesbrough Speed Limit Application.—On the recommendation of the Watch Committee the Town Council are applying to the Ministry of Transport for an order to restrict the speed of motor vehicles to five miles an hour throughout the borough.

Contract for Petrol.—Westminster City Council have accepted an offer by the British Motor Spirit Distributing Company to supply 40,000 gallons of second quality petrol during the year ending July 13, 1923, at 1s. 7½d. per gallon, subject to variations if the market price rises or falls.

Coaches for Fair Traffic.—During Preston Guild week, in the first week of September, it is estimated that there were over one thousand coaches running into the town. The fair is held at intervals of twenty years, and it is stated that half a million visitors went into the town.

Heavy Traffic Test Case.—In view of the far-reaching effects of the judgment against Glasgow Corporation in the case against a firm in respect of damage to streets by traffic of excessive weight, the Statute Labour Committee of the Corporation now propose to appeal to the House of Lords.

Sunderland Heavy Traffic Diversion.—The Town Council have decided to construct, at a cost of £50,000, a new road from Ryhope to Durham Road, in order to provide a through route from the south to the west end of the town. Much of the heavy traffic which now passes into the town could then be diverted.

Manchester-Liverpool Traffic.—The traffic census taken by the Warrington Rural Council showed that the number of heavy motor wagons which passed given points during a period of twelve hours was as follows—Warick Road, 415; Newton Road, 254; Liverpool Road, 1,401; Manchester Road, 988.

Catering for Coaches at Ripon.—The Town Clerk of Ripon has prepared a booklet describing places of interest in the town and its vicinity, for distribution among coach firms and their passengers. Adjoining the Spa Gardens a coach station has been established with waiting-room, lavatories, and cloak-room accommodation.

Near East Motor Services.—Replying to a question in the House of Commons, Mr. Churchill stated that the motor omnibus service between Baghdad and Aleppo was a private venture committing the Government to no expense. Mr. Churchill added that certain private groups had been considering linking up Mesopotamia by motor transport with Syria or Palestine.

Motor Traffic and Brooklyn Bridge Instability.—Brooklyn suspension bridge is reported to be in danger. Engineers state that the strain of 8 and 10-ton lorries, driving at high speed, has imposed a stress for which the bridge was not designed. The bridge carries four tracks for trains and tramways. As a result of increased traffic weight the expenditure on repairs has been very heavy.

Water Supply for Steam Vehicles.—The committee, composed of representatives of the British Waterworks Association, the C.M.U.A., and the Society of Motor Manufacturers and Traders, appointed to adjudicate on the best design for a lock mechanism for the supply of water by the roadside to steam vehicles, have awarded the premium to Mr. A. R. Heath, of Bexley Heath.

Where Drivers are Examined.—At Auckland New Zealand, the traffic duties imposed on local authorities by various Acts of the Legislature are entrusted to a Traffic Department. One duty is the examination of every applicant for a motor driving licence. Before a licence is issued the applicant has to satisfy an inspector that he is competent to drive and control a car. In Great Britain there is only a voluntary examination carried out by the Royal A.C. Very few drivers of commercial vehicles enter this test.

Motor Services in Aberdeen.—Mr. William Forbes, general manager of the Aberdeen Corporation Tramways, in his report for the past year, says that the motor coach tours proved extremely popular, the vehicles being taxed to the utmost capacity. For the year ended May 31 the motor department produced a revenue of £11,650. The working expenses were £8,443, and the gross profit £3,207. There are seven omnibuses and two coaches, and it is proposed to purchase additional coaches for next season's traffic.

Menai Bridge and Heavy Motors.—Replying to an inquiry from the Liverpool area of the Commercial Motor Users' Association, the Ministry of Transport state that the department's engineers are carrying out an extension of the suspension bridge spanning the Menai Straits. The bridge is the only means of access to Anglesea, and as it is barred to vehicles weighing over 4¼ tons, sufficiently heavy loads cannot be sent to make motor transport profitable. The Ministry intend to issue fresh regulations if the bridge is found capable of bearing heavier loads.

British Coaches on the Continent.—The recent announcement that the triptyque and international travelling pass facilities which have been in operation for motor cars for some years have now been extended, so far as England and France are concerned, to motor coaches and omnibuses, is likely to be of considerable importance to British coach undertakings and to British tourists travelling to the Continent. Under this system it is now possible for those vehicles, with the passengers, to be taken from England to France without the payment of a very considerable import duty. The Commercial Motor Users' Association is in a position to extend these facilities to its members.

Road Vehicle Taxation Receipts.—A return issued by the Ministry of Transport shows that the total receipts from the taxation of road vehicles between December 1 and May 31 amounted to £9,558,375. The aggregate number of motor licences issued during this period was 883,921, while licences in respect of private and hackney horse-drawn carriages numbered 214,465. Among the classified receipts are the following –

	No. of Licences.	Tax Receipts.
Cars taxed on horse-power	276,271	£4,188,629
Motor cycles	335,796	784,556
Commercial vehicles	144,674	2,790,120
Road locomotives	2,314	44,810
Motor tractors, etc.	1,399	18,280
Motor hackneys	74,839	1,305,938
Tramcars	13,559	10,172
General identification marks	9,460	68,841

HINTS TO COACH DRIVERS.

The London Safety First Council have issued a poster setting forth hints to coach drivers and inviting their co-operation in the prevention of accidents.

1. Test your brakes before leaving the garage.
2. Securely fasten doors before starting.
3. See that hood and straps—whether or not in use—are secured.
4. Do not allow passengers to interfere with the free movements of your arms and feet.
5. Observe speed limits, especially when near schools or going through villages.
6. Give way to faster traffic. Slow down when passing horses.
7. Proceed cautiously when approaching cross-roads, corners, and concealed turnings. Sound the horn.
8. Descend hills at low speed.
9. When passing traffic on country roads, beware of soft ground at the roadside.
10. Warn passengers of overhanging trees and hedges.
11. Never allow your attention to be distracted by passengers.
12. Keep to main roads. In by-ways there may be weak culverts —or bridges. Short cuts may be dangerous!

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, OCTOBER 12, 1922. VOL. LII.

ELECTRIFICATION OF THE PAULISTA RAILWAY.

One of the most important railway electrification schemes in South America was inaugurated on July 1 last, when the first section of the Paulista Railway in Brazil was formally opened under electric traction, the ceremony being performed by Dr. Washington Luiz, President of the State of San Paulo. The section in question, which extends from Jundiahy to Campinas, is 28 miles long, and embraces 76 miles of single track. The whole scheme, when completed, will cover a distance of over 248 miles. The cost of the part of the electrification work which has been completed is put at £760,000. Electric energy is supplied by the Sao Paulo Electric Power Company from its station at Sorocaba, and is delivered to a sub-station erected at Louveira. The transmission pressure is 88,000 volts, and at the sub-station it is stepped down and converted to direct current at 3,000 volts, which is used on the overhead wire conductors. This is the second instance in the world of collection at 3,000 volts direct current from overhead contact wires.

The railway company hope that the following improvements and economies will be effected by the electrification—(1) The fuel bill will be reduced by one-third; (2) economy in personnel, rolling stock, water supply, etc.; (3) a time saving on the 44 kilometres track of 15 minutes, and over the full track of 400 kilometres of four hours in future; (4) abolition of oscillation, of sparks and coal dust; (5) the use of wood fuel will be restricted, with a consequent lightening of the forestry problem; and (6) diminution in the importation of foreign coal, of which Brazil railways consume about two-thirds of the supply.

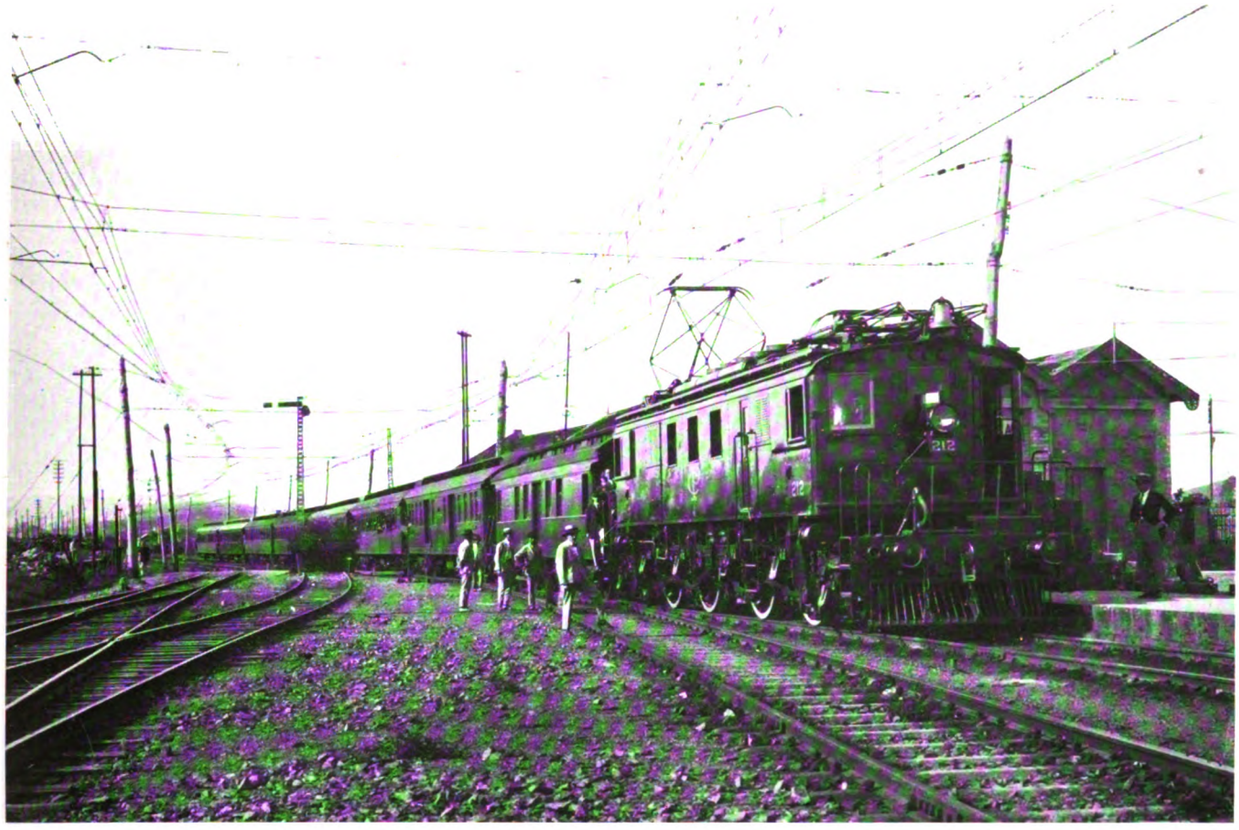

Fig. 1.—Westinghouse Passenger Locomotive and Train—Paulista Railway.

The Paulista Railway has expensive fuel, and 2 per cent. grades are not uncommon. With steam loco-

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motives the traffic had at times exceeded the capacity of the main line tracks of 5 ft. 3 in. gauge, now being operated electrically. Coal at present in Jundiahy costs 92 milreis per ton, or nearly £3 sterling at present rate of exchange. Wood costs 8½ milreis per cubic metre delivered to the locomotives on the broad gauge lines, Rio Claro to Jundiahy. Nine cubic metres of wood are equivalent to one ton of coal. Careful experiment on this railway has shown one kelvin of electricity is equivalent to five pounds of coal, and the maximum price for electricity is 42 reis at the railway sub-station.

The maximum number of trains per day in the two directions between Campinas and Jundiahy is 56. Of these, 40 are goods trains, 20 in each direction. On the average steam locomotives drew passenger trains of 300 tons or goods trains of 500 tons. The maximum speed of electric passenger locomotives is 90 kilometres an hour. The electric goods locomotives can draw 700 tons.

The Paulista Railway Company owns half of the broad gauge railways in the State, and in addition 15 per cent. of the metre gauge lines. There are about 6,000 route kilometres of the latter and 760 kilometres of broad gauge railways in San Paulo.

In regard to the contracts for the electrification, the General Electric Company of Schenectady, U.S.A., supplied and erected overhead line material for 122 kilometres (76 miles), extra high tension transmission for 16 kilometres (10 miles), 4,500 KW. 3,000-volt sub-station complete, eight goods locomotives, weight 90 British tons; and four passenger locomotives, weight 109 British tons. The Westinghouse Company of East Pittsburgh, U.S.A., supplied two goods locomotives, weight 105 British tons; and two passenger locomotives, weight 127 British tons. A representative of the Westinghouse Company has remarked that the Paulista Company's standards of mechanical workmanship and maintenance are higher than those followed on North American railroads, and follow European rather than American practice.

Fig. 1 shows a Westinghouse passenger locomotive coupled to a train, and also indicates the overhead construction. The dimensions of this machine are 52 ft. 11 in. long by 14 ft. 10 in. high. There are eight 63-in. diameter driving wheels and two pony wheels at each end. The weight on each driving axle is 50,900 lb. The four motors are of the W.351 type, with a gear ratio of 86 to 28. The draw-bar pull at one hour rating is 19,400 lb., the speed is 43·2 miles per hour, and the horse-power 2,240. At continuous rating the respective figures are 14,300 lb., 47·2 miles per hour, and 1,800 horse-power.

Fig. 2 shows a G.E. passenger locomotive the dimensions of which are—length, 55 ft.; breadth, 10 ft. 1¼ in.; height, 14 ft. 3 in. The total weight is 109 British tons, which is carried on 16 wheels. Of these eight are driving wheels, 42 in. in diameter, and the weight of each on the four driving axles is 40,000 lb. Four G.E.267 motors are employed, with a gear ratio of 70 to 30. The eight trailer wheels are each 36 in. in diameter. At one hour rating the draw-bar pull is 14,750 lb. at 42·8 miles per hour, giving a horse-power of 1,680. At continuous rating the draw-bar pull is 13,900 lb., the speed 43·4 miles per hour, and the horse-power 1,600. If travelling at a speed above 44 miles per hour, the locomotive regenerates current back to the line.

Fig. 2.—G.E. Passenger Locomotive.

Fig. 3.—G.E. Goods Locomotive.

As to the goods locomotives, Fig. 3 shows a General Electric machine, with dimensions 39 ft. 2 in. long, 10 ft. 1¼ in. wide, and 14 ft. 3 in. high. The weight is given as 90 tons. There are eight driving wheels 42 in. in diameter, and a weight of 50,000 lb. on each driving axle. Four G.E.267 motors with a gear ratio of 82 to 18 are employed. The ratings are—one hour, 28,900 lb. draw-bar pull, 21·8 miles per hour, 1,680 horse-power; continuous, 27,300 lb., 22·1 miles per hour, 1,600 horse-power. Regeneration takes place from 22 miles per hour.

Fig. 4.—Westinghouse Goods Locomotive.

In Fig. 4 is seen a Westinghouse type of goods

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Fig. 5.—Overhead Work on Straight Track.

Fig. 6.—Erecting Overhead Work on Curved Track.

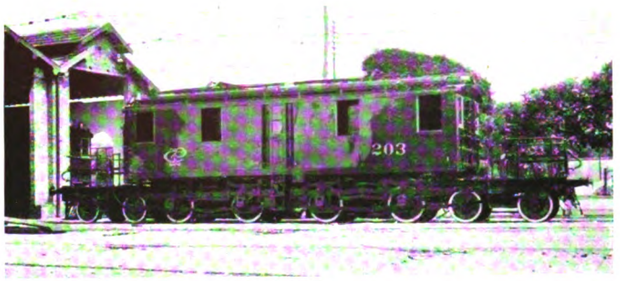

Fig. 10.—Entrance to Locomotive Shed.

Fig. 7.—Overhead Work at Jundiahy.

Fig. 11—Louveira.Sub-station.

Fig. 8.—Wood Poles.

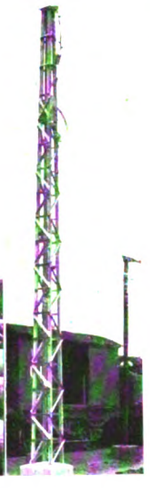

Fig. 9.—Steel Pole.

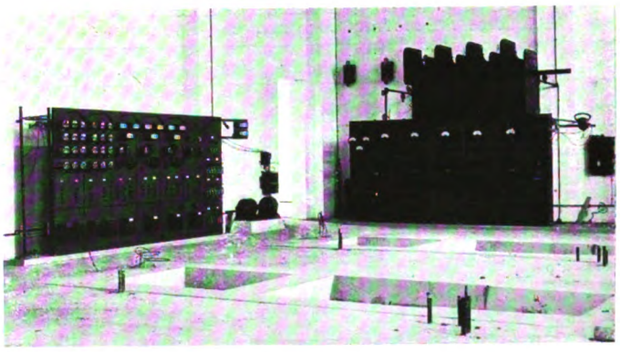

Fig. 14.—Switchboards in Generator Room.

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locomotive, which is 50 ft. 2 in. long by 14 ft. 10 in. high, and has a total weight of 105 tons. There are twelve 40 in. driving wheels, with 39,000 lb. on each axle. Six W.350 motors are fitted with gear teeth respectively of 63 to 16. The ratings are—one hour, draw-bar pull, 29,400 lb.; speed, 21·4 miles per hour; horse-power, 1,680; continuous, draw-bar pull, 21,600 lb.; speed, 23·4 miles per hour; horse-power, 1,350. Excitation of the motors during regeneration is produced by a separate motor generator. These and other details are epitomised in the accompanying table.

A good idea of the permanent way and of the overhead construction, both on the straight and on curves, is given in Figs. 5, 6 and 7. Fig. 7 has Jundiahy passenger station on the left, and the electric locomotive sheds are indicated in the left background. It will be observed that wood poles are extensively used for supporting the overhead construction, and that no great effort has been made to remove inequalities of their surface. The wood used is called Guarantan. Some of the poles which have arrived ready for erection are shown in Fig. 8. The Paulista Company maintain carefully planted and cultivated forests of over 5,000,000 trees for providing sleepers, and from these trees they selected large poles for supporting the overhead structure and feeder cables. Some lattice steel poles are also employed, a sample of which is shown in Fig. 9.

Fig. 10 shows the entrance of the locomotive shed just mentioned. It will be noted that triple insulators terminate the 3,000-volt overhead wires at the entrance to the shed, as, for the sake of safety to workmen, it is not advisable to have such high pressure bare conductors inside the depot. For movements inside the shed 220-volt current is available, and sockets are provided on the locomotives for connecting this lower pressure to the control circuits.

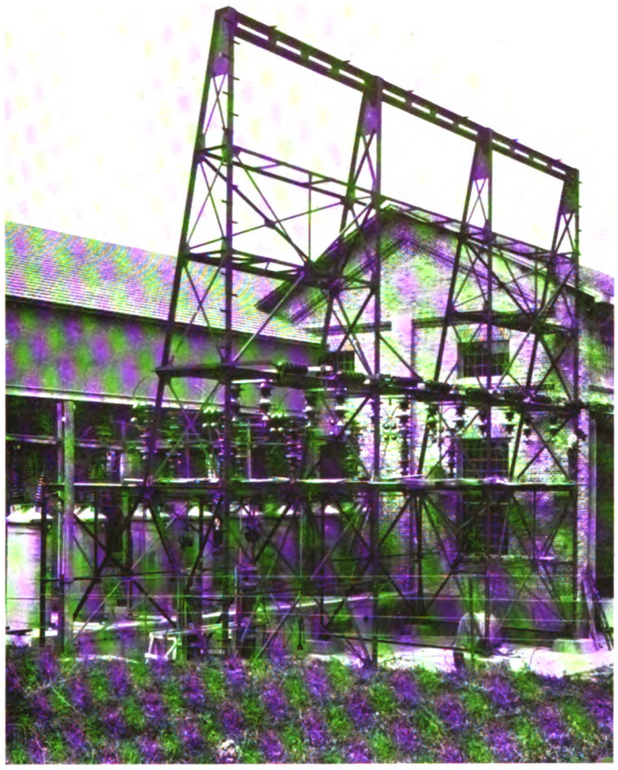

Fig. 12.—Tower and Transformers Outside Sub-station.

Fig. 13.—Main Transformers in Sub-station.

PAULISTA'S ELECTRIC LOCOMOTIVES—FOUR TYPES

Service.	Passenger.	Passenger.	Goods.	Goods.
Total length, feet	53	55	50	39
Total weight, British tons ...	127	109	105	90
Weight per driving axle, tons ..	22	18	17	22
Gear ratio	3·08	2·33	3·94	4·56
Diameter driving wheels	5 ft. 3 in.	3 ft. 6 in.	3 ft. 4 in.	3 ft. 6 in
Rigid wheel base	8 ft. 4 in.	7 ft 9 in.	14 ft. 0 in.	8 ft. 8 in.
Wheel arrangement	2-4-4-2	4-4-4-4	0-6-6-0	0-4-4-0
Trailing load...	400	400	700	700
Continuous rating—				
Tons tractive effort	6·4	6·2	·7	12
Speed, miles per hour	47	43	23	22
Horse-power	1,800	1,600	1,350	1,600
Regeneration speed	—	44	—	22
Regeneration excitation	Separate	One motor	Separate	One motor
No. and type of motor	4 W.351	4 G.E.267	6 W.350	4 G E.267

Water power is well distributed over the southern part of Brazil, and, converted into electricity at the power company's station, it is delivered at 88,000 volts, 3-phase, 60 cycles, at the Louveira sub-station (Fig. 11), situated at kilometre 16 north of Jundiahy. The sub-station contains three 1,900 K.V.A. three-phase transformers supplying three synchronous motors, each driving a pair of 750 KW. 1,500-volt generators and a pair of exciters. The switch-gear includes high-speed circuit breakers on each direct current group, and automtatic switch gear to return regenerated energy to the supply company when the railway regenerates more than it requires for its own use.

Fig. 12 is a detailed view of the tower outside the sub-station ready to receive the extra high tension

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insulators and overhead cables. Behind it may be noticed a novelty in the shape of an out-of-door type of transformers, etc. This plant includes eight aluminium lightning arresters, four voltage instrument transformers, and four current transformers.

An interior view of the sub-station is given in Fig. 13, two of the three main transformers being shown in the illustration. There are two three-phase switches for the incoming 88,000-volt lines, and facing each transformer is a three-phase switch for operating it. Near the roof of the building are the bus bars, the bare connectors, and insulators.

The motor generator room of the sub-station is shown in Fig. 14, but the view was taken before the motor generators were installed. The interest of it lies in the switchboard arrangements. The panel on the extreme right automatically connects to regenerate power back to the supply company when excess power is regenerated. The other panels are for the motor generators, feeders, etc. On the other switchboard, which deals with the high tension current, are the supply company's printing meter, a maximum demand clock, and relay, and the connections for the incoming lines and transformers, air compressor, lighting for the station, auxiliary power, etc.

Scientific training and practical experience are fully appreciated on the Paulista Railway, which is managed by Dr. F. de Monlevade, civil engineer of the Polytechnic College of Rio, an expert of ability and foresight, with a staff of Brazilians of high scientific qualifications, many of whom have had long experience abroad on steam and electric railways. The locomotive repair shops are located at Jundiahy, and have been for thirty years, and are now, under the management of a Brazilian engineer, Mr. S. Storch.

Carriages and wagons are built and repaired at the Rio Claro shops, where a Scotsman, Mr. Adam Gray, has had charge during an equally long period. In both these shops the standards of workmanship and design maintained are equal to any in Europe.

BRIGHTER CARS FOR "THE UNDERGROUND."

The Metropolitan District Railway Company have for some time been alive to the fact that the all-steel rolling stock on the railway could be materially improved in general comfort if more careful consideration were given to the general internal appearance. Whilst these cars leave nothing to be desired as regards safety, comfort, design, and facilities for quick loading and unloading, it was felt that the all-steel construction of the cars produced a corresponding "all-steel" atmosphere. Steps have therefore been taken to brighten up the cars.

Mr. Hall Thorpe, the well-known artist, has been commissioned by the Underground Company to plan pleasing and harmonious colour schemes, and several cars have now been dealt with. Some are in grey relieved with yellow, and are fitted with brown and gold moquette cushions. Some are in blue relieved with white, and are fitted with brown plush cushions in the first-class compartments, and with brown and gold moquette cushions in the third-class. Others are in green relieved with two shades of grey, the cushions being brown and green plush. All seats are fitted with arm rests, and are two inches wider than the old type. The floors are being made more ornamental by the introduction of a kind of foot rest.

The upright rods from floor to ceiling have been dispensed with in favour of straps, and the handles of the doors have been nickelled. The ventilators in the first-class compartments have also been improved. These can now be regulated by the passengers instead of being fixed as at present.

Turning to the outside of the cars, these have been painted a deep brown, and the familiar symbol "London's Underground" appears on the side. One car has been equipped with noise-eliminating devices, the outcome of experiments made by Prof. A. M. Low.

New Decoration of Metropolitan District Railway Car.

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THE
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THE EDITOR will be glad to consider articles by experts. All information of a practical character relating particularly to the engineering and operating branches of transportation will receive prompt attention. Original illustrations will also be welcome.

LONDON, OCTOBER 12, 1922.

Labour Trouble Averted.

Both employers and employed in the tramway industry may be congratulated on the fact that a stoppage has been prevented by the settlement of the dispute as to wages which was arrived at by the National Joint Industrial Council on September 28. Negotiations had been going on for about a fortnight, and sometimes it appeared that they might break down altogether and that the Joint Council might be resolved into independent fragments. Happily, wiser ideas prevailed and a compromise was reached, in which neither side got all it wanted but got a part. It is true that the men's delegate conference subsequently decided to take a ballot of their constituents on the terms proposed, but the ballot papers are accompanied by a recommendation of acceptance. There is thus a good prospect of the trouble being over. The employers, in face of heavy falling off in traffic receipts, wished to abolish the sliding scale of wages and to bring about a speedy reduction in pay of 12s. per week. The men wished the sliding scale to remain as it was. In the result the sliding scale has been retained, but it has been made somewhat steeper, and it is to be retrospective so as to begin with an immediate reduction of 4s. per week. The agreement, which was arrived at between the parties in June 1921, provided that from the commencement of the first full pay period in August subsequent reductions from and additions to wages should be at the rate of 1s. per week for each five points variation either way in the cost of living index figure from the original standard of 135, the adjustment to be regulated every three months. The new agreement continues the sliding scale, but from the first full pay period in October deductions from and additions to wages are to be at the rate of 1s. for each four points variation in the cost of living index figure. The next adjustment, however, is not to take place till February 1923; subsequent adjustments will be made every three months. The agreement is to last until September 1 next year, and thereafter, as in the case of the old agreement, it will be terminable by three months' notice from either side. The present reduction of 4s. per week is in favour of the employers. It means that the 1s. decrease for every four points fall in the index figure is now to be retrospective back to the 135 standard. Thus, under the old sliding scale the last adjustment was made when the index figure was 85, giving a total wage reduction of 10s. Now the index figure is 79, or 56 points below the original. Under the new sliding scale of 1s. wage reduction for every four points, that produces a total wage reduction of 14s. Hence the present drop of 4s. If the new sliding scale had only been applied to the last fall of six points in the index figure, the wage reduction would have been 1s. 6d. The terms, nevertheless, are very generous to the employees, and it may be questioned whether tramway authorities will get nearly as much relief as they require. Much depends on how traffic receipts move, and that again depends on the state of trade and the maintenance of fares at something like a remunerative level. In such dubiety, tramway companies are, of course, in a worse position than municipalities, because the latter can as a last resort fall back on the rates, while there is no such comfort for the shareholders in the companies. The position of some companies is already difficult, but it is necessary as long

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as they adhere to the Joint Council that they shall abide by its decisions. Moreover, it is not so easy for them to take up an independent position and retire from the Council, as some municipalities have done. In any event, peace has been secured for another year, and before the twelve months have elapsed a great deal may happen, probably for the better, if possibly for the worse, which will call for a new settlement. Tramway undertakings must meanwhile struggle on. They have not secured as large reductions in wages as they considered necessary, so the greater the economies which must be attempted in other directions. No one wants to see wages brought down to pre-war level, but by the time of the next settlement the fact already dawning on the employees will probably be more apparent to them, namely, that wages must be such as to allow a margin on the right side in the working of any undertaking.

The Tramway Conference. The coming-of-age conference of the Municipal Tramways Association last month proved worthy of the occasion. The shades of a useful past were recalled not merely for their own sake, but as an incentive to further effort. The subjects which were discussed are of immediate and pressing importance and some of the resolutions passed showed a greater tendency than of yore to take all possible action by legislation to remove long-standing and growing grievances and injustice. The presidential address by Alderman Richard Mayne was a useful review, both of the past and of the present, and it was strong on the point that no other method of city street passenger transportation can hope to take the place of the electric tramcar. His objection, however, to the Government guarantee on additional capital and interest for developing the London underground railways is open to the reply that municipal tramways have, and always have had, a similar guarantee—namely, the security of the rates. In both cases the result is the same—capital can be raised at a lower rate than would otherwise be the case.

The Penny Fare. Mr. Ernest Hatton was able to adduce strong arguments for the retention of the penny minimum fare, so far as Newcastle is concerned, but representatives of tramway systems in various parts of the country expressed themselves strongly against a minimum lower than 1½d. In present conditions of high wages and falling off in traffic through bad trade, they regarded the penny stage of previous times as ruinous. Everybody agreed that it is desirable to get working expenses down, but no one was able to explain how this is to be done. Nobody wanted to bring tramwaymen's wages down to pre-war level. A solution which found acceptance in various quarters is to have a penny minimum, but to shorten the distance of that stage as much as may be necessary to make it pay. On the other hand, if it is very short, people will prefer to walk. There was a comparatively short discussion on a legal question introduced by Mr. P. M. Heath. The grievance is that tramway authorities are liable for electrolytic damage done to telegraph and telephone cables by stray tramway currents, even though it is shown that the agents of the Postmaster General have been negligent. The conference decided that a committee should be appointed to confer with Post Office experts on the subject.

Car Improvements Wanted. Perhaps the most interesting of the papers was that on tramway rolling stock by Mr. E. S. Rayner. It certainly was the most novel, and Mr. Rayner showed himself to be something of a revolutionary in the matter. The part of his paper advocating the cutting down of weight was not so novel, but, when he went on, in advocating a more flexible understructure, to recommend, as a means thereto, the adoption of many of the features of the automobile vehicle, some of his hearers took objection. There can be no cavil, however, regarding the contention that as much of the weight as possible should be spring-borne—and that for the benefit both of the car and of the track. But many members were not convinced of the desirability of adopting the propeller shaft with bevel or worm gearing. The same remark applies to the suggestion of a differential in the car axle to help in rounding curves, and the use of roller and ball bearings and of internal expanding brakes. Mr. Rayner is now working on a car to carry out his ideas—and we shall see what we shall see. In the discussion there was general agreement

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as to the desirability of reducing weight, such as must be obtained by smaller and higher speed motors. As to roller and ball bearings, some members who had tried them found them advantageous and some the reverse, and one or two members who had tried a differential axle did not favour it. All agreed as to the value of the paper in breaking new ground and all wished Mr. Rayner success in his experiments.

The Bitter Cry.

A return from the somewhat theoretical to the intensely practical was made when the conference discussed the long-standing and ever-growing grievance of tramway authorities that they have to pay the whole cost of road construction and maintenance of the road surface between the rails and between the tracks. The rapid increase in the number of heavy motor vehicles which wear out the road surface, whilst tramcars do not wear it at all, is making the liability of the tramways for road maintenance overwhelming. Mr. Henry Mattinson, who introduced the discussion, was quite moderate in his claims. Briefly they were that tramway authorities should be allowed the constructional cost of the highway part of the tramway so far as it can be shown to represent a cost which the highway authority would otherwise have to incur, and that a grant should be given towards the maintenance of the highway portion of the track based on the ascertained cost of the portions of the same road outside the tramway area. In the discussion it was pointed out that if costs were apportioned in proportion to user, it would be possible materially to reduce tramway fares. The fact is, that at present the tramway passenger has to pay for road wear caused by other vehicles. It was decided to approach the municipal authorities of the country and to ask them to agree to the principle that road charges should be apportioned to the proper accounts. The idea is that that should be followed by promoting a Bill in Parliament to amend the antiquated provisions of the Tramways Act of 1870 on the subject. The Executive Council were also instructed to take action for the purpose of securing legislation to enable local authorities to make bye-laws for the purpose of regulating general street traffic at tramway stopping places.

THE WAGES REDUCTION PROPOSALS.

JOINT COUNCIL'S AGREEMENT.

The crisis in the tramway industry owing to the proposed reductions of the employees' wages continued almost to the end of September. Anxious negotiations occupied several days during which the representatives of employers and employees who form the Tramways Joint National Council met at the office of the Ministry of Labour, and sought to find a way out of the difficulty. Mr. J. B. Hamilton, general manager of the Leeds Corporation Tramways, acted as spokesman for the employers, while the employees' case was argued by Messrs. H. Gosling, L.C.C., E. Bevin, J. Cliff, and R. Williams. Eventually a solution to the problem was found on September 28, when the Joint Council agreed on terms of settlement.

A delegate conference of the Transport and General Workers' Union decided to ballot members and to recommend acceptance of the terms, which are as follow—

(*a*) The present rate of wages shall be maintained until the commencement of the first full pay period in October 1922.

(*b*) That on and from the commencement of the first full pay period in October 1922, deductions from and additions to wages shall be at the rate of 1s. for each complete four points variation either way in the cost of living index figure (all items included) published in the *Labour Gazette*, commencing from the figure of 135 per cent. over August 1914, in respect of the maximum war wage increase of 40s. per week.

(*c*) That on and from the commencement of the first full pay period in October 1922, the present rates of wages shall be reduced by a sum of 4s. per week, in accordance with the cost of living index figure at September 1, 1922—namely, 79 per cent.

(*d*) That thereafter adjustments shall be regulated every three months, subject to the condition that the next following adjustment shall be made on and from the commencement of the first full pay period in February 1923, and shall be determined by the cost of living index figure as published in the *Labour Gazette* for January 1923, and thereafter by the index figure for the month preceding each adjustment.

(*e*) In the case of any undertaking where the total war wage increase of 40s. (exclusive of basic rate increase) is not now being paid no reduction in wages shall operate on such undertakings until the rate of increase is equal to the current general increase obtaining in the industry.

(*f*) Alterations in the rates of wages of employees under eighteen years of age, except those employed as parcels, messenger, point, and trolley boys, shall be regulated in accordance with the terms of this agreement, except that the reductions from, or additions to, wages shall be at the rate of 6d. for each complete four points variation.

(*g*) That the methods of calculating payment of wages shall be the same as are now in operation in the various undertakings.

(*h*) This agreement shall be terminable by three months' notice in writing, which may be given by either side to the other, but no such notice shall be given so as to terminate earlier than September 1, 1923.

(*i*) The joint secretaries shall issue to the parties concerned prior to such periodical adjustment of wages the cost of living index figure as published in the *Labour Gazette* together with a statement of the amount of wages adjustments required to be made under this agreement.

The following has been sent to tramway authorities—

The new sliding scale is based upon four points for each 1s., in lieu of five points in the previous agreement, and the reduction of 4s. to be made on and from the commencement of the first full pay period in October 1922, has been arrived at as follows—

The datum figure adopted in the previous agreement was	135 points
And the variations therefrom were made at the rate of five points for 1s. The last adjustment was made upon the index figure of	85 points
or a difference of	50 points
representing 10s.	
Under the new scale the datum figure is the same, viz.	135 points
The index figure on September 1, 1922, was...	79 points
or a difference of	56 points

which at 1s. for each four points represents 14s.

The deduction therefore from the maximum war wage increase of 40s. for adults will be, on and from the period named, 14s. per week, and 7s. per week from the war wage increase for employees under 18, except the four grades referred to in the agreement.

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THE MUNICIPAL TRAMWAYS ASSOCIATION

(INCORPORATED)

21st Annual Conference held at Newcastle-on-Tyne September 13, 14 and 15, 1922.

SPECIAL REPORT.

So uniformly successful are the annual conferences of the Municipal Tramways Association that it is sufficient to say of the recent gathering at Newcastle that it fully equalled any of its predecessors in interest and importance. As this was the twenty-first conference, and the Association had just completed a year of great activity and much usefulness, an air of confidence and hopefulness prevailed, although the industry was at the time in the crux of a disturbing labour problem. Almost all the municipal tramway undertakings of the country were represented, and the delegates numbered nearly two hundred. The programme included the customary presidential address, and the reading and discussion of four papers on topics which, if not new, are of ever increasing importance to the industry, were carried out with a degree of energy and despatch that might well be imitated by many Town Councils whose delegates attended. This happy result was largely attributable to the tact and urbanity with which the president, Alderman R. Mayne, conducted the business of the conference. His long experience as councillor and alderman of the city of Newcastle, and particularly as chairman of the Transport and Electricity Committee of the Council, eminently fitted him to preside over an assembly where differences of opinion are as sharply contrasted as they are freely expressed; and the vote of thanks which was accorded to him at the close of the conference was more than a formality. The members were cordially appreciative of his services not only as president during an eventful year, but of the many arrangements made with much thoughtful hospitality for their comfort and entertainment during the conference. Nothing was overlooked, and everything was provided for; by not overloading the programme some leisure moments were left to the delegates, who were thus able to enjoy a feeling of freedom that has sometimes been lacking at previous conferences. The opportunity thus afforded of conferring informally with colleagues not often met is by no means the least valuable feature of these gatherings; but if the time is wholly taken up with arrangements made by an over anxious hospitality the opportunity for meeting old acquaintances and making new ones is reduced to vanishing point. At Newcastle our experienced hosts happily combined just that amount of entertainment and freedom which a guest appreciates.

Just the right note was given to the conference at an informal reception on the Tuesday evening, when the president, assisted by Mrs. Mayne, Mr. Hatton (general manager of the Newcastle Tramways), and Mrs. Hatton received the members at the County Hotel. Many members of the Newcastle Transport and Electricity Committee, with other city aldermen and councillors, were also present. The evening trains brought delegates from all parts of the country, and as most of them were stopping at hotels close at hand, the invitation of the president was most opportune, and a large company attended. The reception rooms at the County Hotel were in fact crowded throughout the evening. A programme of music was rendered by singers from the cathedral choir, and refreshments were served during the evening.

On Wednesday morning the conference was formally opened in the lecture hall of the Newcastle Literary and Philosophical Society, where the Association was warmly welcomed by the Lord Mayor (Alderman R. H. Millican), accompanied by the Sheriff (Councillor James Lunn), the Town Clerk (Mr. A. M. Oliver), and many members of the Council. The Lord Mayor expressed the pleasure he felt that the Association was paying its first visit to Newcastle when it was celebrating its majority, and that his old friend Alderman Mayne had been chosen as their president.

The Lord Mayor's welcome on behalf of the city was briefly responded to by the president, and on the motion of Sir John Timpson, the vice-president, seconded by Mr. A. L. C. Fell, a vote of thanks was passed to the Lord Mayor and Sheriff for their welcome and presence.

Alderman Mayne then read his presidential address, which was followed with close attention throughout. He said that they were celebrating the twenty-first anniversary of the Association, and it was a pleasure to know that some of the founders were still connected with them. Among these were Mr. John Young, their original president, and Messrs. Aldworth, Baker, Bellamy, Fell, Hatton, and McElroy. To these gentlemen they were largely indebted for "their nurture, their preservation, and their progress." Out of 102 municipally operated tramways, 95 were now included in their membership. It had become an insistent custom in some quarters to declaim against tramways, and to assume that they had had their day. Too much attention need not be paid to criticism of that character, nor indeed to any critic who deliberately shut his eyes to the facts. A short survey of tramway history followed, and the present position of the industry was incisively dealt with. The enormous growth of tramway business was emphasised by a comparison of figures at intervals of ten years since 1881. In that year the number of passengers carried was 205,624,000; the corresponding figures of 1921 were 4,863,968,000. Obviously tramways met a great necessity, and the vehicle had yet to be devised that could compete successfully with them in carrying the industrial population at a low rate. "I do not hesitate," said the president, "therefore to proclaim the continued public necessity for tramways, nor to affirm with emphasis that on equal terms they can compete with all their rivals and competitors." Then followed a statement of the special difficulties with which the industry has to contend, and the bold declaration, "if nothing short of monopoly can secure to the community a self-sustaining and efficient service, then on broad grounds of public policy and in the public interests we place our claim as high as that." The address, the full text of which is given in our special report of the conference in the following pages, struck a virile note which met with an enthusiastic response from the conference.

Mr. Ernest Hatton, general manager of Newcastle Tramways, then read a paper entitled "An Argument for the Penny Fare, Demonstrated by Actual Experience," which led to the most pungent and interesting, if somewhat desultory, discussion in which the conference has ever engaged. The result will probably be to hasten the reintroduction of the penny fare and its extension.

It was evident that Mr. Hatton's contention was not clearly understood, and many speakers assumed that he argued in favour of a general penny fare. This, of course, was not the case. Mr. Hatton's view was that every system could afford to give some ride for a penny; but the length of stage and other details he would no doubt expect to be determined by local conditions. Mr. A. Baker, who opened the discussion, thought that few of those present would agree with the paper. The test of the penny fare was expenses. Wages represented 60 to 65 per cent. of the total costs, and tramway men were getting 130 to 140 per cent. per hour more than in July 1914. Doubtless reduction would have to be made, but he thought wages would never come down to the 1914 level; indeed, he hoped they would not. Tramway fares had always been too low in this country to provide a sufficient margin for emergencies. Other speakers included Alderman C. Higham (Blackburn), W. G. Turner (Belfast), Alderman F. Smith (Liverpool), B. Clarkin and W. Murray (Walthamstow), T. Wolfenden (Huddersfield), J. Barnard (Bolton), Baillie Smith (Ayr), J. Dalrymple (Glasgow), Alderman T. S. James (Northampton), and J. H. Whittaker (Todmorden); and after an interval for luncheon they were followed by Messrs. G. W. Holford (Salford), A. L. C. Fell (London), J. S. D. Moffet (Belfast), W. Chamberlain (Oldham), Alderman R. F. Fletcher, and H. P. Stokes (Plymouth), and Mr. Hatton replied.

Various views were expressed, but the general opinion emerged that while a penny fare was desirable, the time had not yet arrived for it to be generally practicable. One or two speakers, turning from the thesis set out in the paper, appeared to advocate free riding at the expense of the long-suffering ratepayer; there was, however, general agreement with the contention that while local circumstances must govern details of fare-making, the principle must be accepted that the passenger should pay for his ride; and that the penny fare was feasible only in so far as it covered the full cost of carrying the passenger the full distance he was allowed to travel for that fare. In an energetic and characteristic reply, Mr. Hatton

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made it clear that he had not intended to press for the reversion to the pre-war penny fare, but had argued that a passenger should be able to travel some distance for a penny. Tramways, he added, must be brought within the reach of the purse of the people, and Newcastle was endeavouring to do that. Mr. Chas. Furness (Blackpool) moved, and Mr. Baker seconded, a vote of thanks to Mr. Hatton, which was carried with acclamation.

Mr. J. Beckett, general secretary of the Association, then read a paper prepared by Mr. P. Heath (Town Clerk of Manchester), who was unable to be present, on "The Legal Aspect of the Question of Electrolysis." It was pointed out that the substance of the present legal position was that if tramway undertakers observed the Board of Trade regulations they were not liable for electrolytic damage to pipes, etc., belonging to other undertakings, except in the case of the Post Office. In the latter case they were liable to make good damage to telegraph and telephone cables, even though there had been negligence on the part of the agents of the Postmaster-General. The law in that respect ought to be altered.

Mr. A. L. C. Fell (London) opened the discussion, and was followed by Messrs. J. B. Hamilton (Leeds), C. Furness (Blackpool), J. F. Cameron (Northampton), C. J. Spencer (London), and E. S. Rayner (Hull). At the conclusion the following resolution was passed—

> "That the conference is of opinion that a small Technical Committee should be appointed by the Executive Committee to go into the whole question now under consideration, and that the Postmaster-General be asked to allow this committee to confer with the technical officers of the Post Office in order to discuss the matter with a view to arriving at an amicable and satisfactory solution of the problem, and that the Executive be instructed to make the necessary arrangements."

It was agreed to send the resolution to the Tramways and Light Railways Association with a request to co-operate, and the Council is to consider asking the Association of Municipal Corporations and the Incorporated Municipal Electrical Association to assist.

The conference then adjourned for the day, and the members emerged from the lecture hall to find the wet and dismal weather which had prevailed since morning still dominant. During the day the ladies of the party, who had left the conference after the Lord Mayor's welcome, had taken part in various outings which were to a large degree spoiled by the incessant rain. A special programme had been prepared for them, and early in the day they made a tour of the city in motor omnibuses, visited the interesting old castle, Blackgate Museum, and Trinity House on the Quayside. In the afternoon a tour to the coast was made via Gosforth Park, tea being served at the Grand Hotel, Tynemouth.

When the conference reassembled on Thursday morning, Alderman Mayne again presided, and called upon Mr. E. S. Rayner, who read his paper treating of "Tramway Rolling Stock," supplementing it with explanations in a way that held the closest attention of the members. He said that the mistake they suffered from to-day was the attempt to build rolling stock on the same rigid principle as they built track. Rigidity had been a fetish. In his opinion all their troubles were traceable directly or indirectly to this rigidity, together with the unsprung weight on axles and the very inadequate springing of the remainder of the car. The rigidity of tramway track should be compensated by resiliency in the design of the rolling stock. He thought springing was a much neglected science. They had been trying to cure the troubles caused by a rigid track by making cars more rigid. The result was that the weight had been increased out of all proportion to the useful work required. They must have lighter cars, and that meant lighter equipment. (A detailed schedule was included, giving the weight of each item in a standard Brill 21E truck equipped with a G.E.52 motor and B.T.H.K.10 controllers.) In tramcar construction they ought to take advantage of the dearly-bought experience with motor vehicles. He was convinced that no insurmountable difficulty would be found in adopting the type of drive used in motor vehicles to tramway work; the advantages would far outweigh the disadvantages. Another bad feature of tramway car work was the solid axles without the interposition of a differential. Sufficient advantage had not been taken of roller and ball bearings, owing to the fact that in every case it would mean conversion; and perhaps the conversion of the manager was the most difficult part of the work. The saving in friction amounted to about 20 per cent., but the principal saving would be in the decreased starting effort and the decreased cost of lubrication. Brakes badly needed re-designing, and he saw no serious difficulty in applying the ordinary internal expanding brake of a motor car to tramway-car braking. The weight of the truck could be decreased at least 25 per cent. Wheels and axles were another source of weight. Excessive dead weight on their axles and wheels tended towards corrugation. He had obtained some surprising results by taking out the car-miles per mile of rail for the whole of the Hull system since it was installed. The figures showed that the wear was proportional to the average speed. At Hull they were now working on a new car in which the springing would be as easy as possible and the weight would be cut down to the lowest possible figure compatible with safety and stability.

The President, in inviting discussion, congratulated Mr. Rayner upon his paper, remarking that his experiments were of quite a revolutionary nature to meet the question of weight and its relation to track.

The discussion was opened by an interesting address by Mr. R S. Pilcher (Edinburgh), and he was followed by W. M. Milnes (Wigan), C. O. Silvers (Wolverhampton), C. J. Spencer (London), B. Hall (Halifax), P. Priestly (Liverpool), Ald. T. Canby (Huddersfield), A. R. Fearnley, Sheffield.

Mr. C. J. Spencer (London) stressed the importance of reducing costs by adopting new methods, and suggested the formation of a research committee representative of the Association which might confer with manufacturers. He was confident that the Tramway and Light Railway Association would co-operate with such a committee. The president thought, however, that the time was not quite ripe for such a committee, and the suggestion was left for future consideration.

The next paper was by Mr. H. Mattinson, general manager of Manchester Corporation Tramways, and dealt with "Highway Costs Borne by Tramways." Mr. Mattinson recapitulated the liabilities that tramways are under in connection with the highways, and stated the justification of their claims for relief, outlining the steps that are necessary to make these claims effective. They were, he said, limited to two, (a) the constructional cost of the highway portion so far as it can be shown to represent a cost the highways authority would necessarily incur; (b) a grant toward maintenance of the highway portion based on the ascertained cost of the portions of the same road outside the tramway area inclusive of any Government grant in aid.

Mr. J. B. Hamilton thought that it might be necessary to promote a private Bill to bring antiquated regulations relating to tramways up to date, and suggested that municipal authorities be asked to say that road charges should be appropriated to their proper accounts.

Mr. Ernest Hatton electrified the assembly by entirely disagreeing with what may be termed the orthodox view of the road maintenance problem, declaring stoutly that as tramways occupied the central road positions they should pay for the use of them. Alderman W. C. Fenton (Sheffield) contested Mr. Hatton's statement, and contended that tramways had too long been regarded by municipalities as milch cows. It was time a proper adjustment was arrived at. Mr. E. S. Rayner declared that it was a fallacy to say that the tramways monopolised the roads. They used only that portion of the road on which at any moment they happened to be running, just as any other vehicle did. Tramways should maintain rails and foundations, and road costs should be fairly apportioned to all road users. Other speakers in the discussion included Mr. L. E. Davey (Ilford), the Mayor of Halifax, Mr. L. C. F. Bellamy (St. Helens), and Mr. H. P. Stokes (Plymouth). Mr. Hamilton's suggestion was adopted, and it is to be hoped that it will lead to some practical result.

The President closed the discussion, and called on Mr. A. L. C. Fell, who presented a request (given in full in following pages) from the London County Council that the conference should give consideration to the regulation of tramway stopping places.

The importance of the matter was emphasised by several speakers. Mr. J. Dalrymple (Glasgow) gave an account of the position in that city. For the last ten years they had in force a by-law prohibiting vehicles from endangering tramcar passengers while alighting or boarding, and the effect had been most beneficial. Mr. Fell suggested that the matter be referred to the Executive Committee with a view to action, and it was agreed that this should be done. The conference adjourned shortly after four o'clock.

During the day the ladies were again engaged in sight-seeing, but the disagreeable weather persisted, and much interfered with the pleasure of the outing to Jesmond Dene, a very charming park of which Newcastle is justly proud. Here they were entertained to luncheon, and in the afternoon they were shown over the offices of the *Newcastle Chronicle* and witnessed the production of an issue of an evening paper.

In the evening the members of the conference and other guests were entertained to dinner at the Grand Assembly Rooms, Barras Bridge, by the chairman (Alderman Mayne), the vice-chairman (Sir Arthur Sutherland), and members of the Newcastle-upon-Tyne Transport and Electricity Committee. The guests were received by the chairman of the committee and Mrs. Richard Mayne. The dining room was gaily decorated, and presented a bright and animated scene. During the after-dinner speeches a presentation of two handsome clocks was made to Mr. J. M. McElroy, who has recently retired owing to ill-health from the management of the Manchester Corporation Tramways and the Executive Council of the Association,

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and who has been a member of the Council of the Municipal Tramways Association since its inception.

After dinner there was an informal conversazione and dance, in which many of the guests participated.

ANNUAL MEETING AND ELECTION OF OFFICERS.

On Friday morning the Annual General Meeting was held. The general secretary (Mr. J. Beckett) having read the minutes of the last general meeting, the report of the Executive Committee was unanimously adopted. The report, which extends to over 50 pages, is a notable record of useful work during a year of exceptional difficulty and it reflects much credit both on the Council and the general secretary who has been untiring in his efforts on behalf of the Association. Various other business was transacted and the usual election of officers took place.

Sir John Timpson, K.B.E., R.S.O. (Serbia), K.S.T. (Japan), chairman of Portsmouth Tramways Committee was unanimously appointed president for the ensuing year, and Mr. J. Barnard, general manager of Bolton Corporation Tramways was unanimously appointed vice-president. Mr. J. M. McElroy was unanimously elected an honorary member. The newly elected president and the general secretary (Mr. J. Beckett) were appointed to represent the Association at the Congress of the International Tramways, Light Railways and Public Automobile Union at Brussels, which will have met before this issue is published.

In the afternoon, at the invitation of the Transport and Electricity Committee, members of the conference and the ladies journeyed by motor omnibuses to Chollerford and Hexham. The route taken was along the hills by the old Roman road, and in brilliant flashes of the afternoon sun the visitors had splendid views of the magnificent scenery of the district. At Chollerford they inspected the remains of the Roman camp Cilurnum where the conference photograph was taken. The return journey was made by way of Hexham where tea was provided at the Queen's Hall. Alderman R. Mayne took the chair, and with him were the Lord Mayor of Newcastle (Alderman R. H. Millican) and the Lady Mayoress (Miss Rita Millican), who joined the party at Hexham. An opportunity was taken to present on behalf of the visitors handsome bouquets to the Lady Mayoress, to Mrs. Richard Mayne, Mrs. Harry Lawson and Mrs. Ernest Hatton.

In the early evening the party returned to Newcastle. The afternoon was brilliantly fine and the excursion formed a pleasant termination to one of the most successful and enjoyable conferences that the Association has ever held. The members will long recall the twenty-first anniversary of the founding of the Association and the delightful hospitality with which they were received by the Lord Mayor (Alderman Millican), Alderman Mayne, his colleagues of the Transport and Electricity Committee, the tramway officers and many other representatives of the City of Newcasrle.

LIST OF MEMBERS AND DELEGATES.

Aberdeen	Coun. David W. Beaton, convener. Wm. Forbes, general manager.
Accrington	Coun. F. Lord, vice-chairman. H. Pilling, general manager.
Ashton-under-Lyne ...	C. I. Baker, general manager.
Ayr	Bailie James Smith, convener. Wm. Grant, general manager.
Barrow-in-Furness ...	Coun. Lt. Col. R. Thompson, chairman. J. R. Groves, general manager.
Belfast	Coun. W. G. Turner, chairman. Coun. D. Anderson, vice-chairman. J. S. D. Moffet, general manager.
Birkenhead	Coun. H. Halsall, chairman. C. Clarke, general manager. Coun. T. Bishop, vice-chairman.
Birmingham	Coun. J. W. Bishop, vice-chairman. A. Baker, general manager. A. C. Baker, chief engineer.
Blackburn	Ald. C. Higham, chairman. Coun. G. Burke, vice-chairman. J. H. Cowell, general manager.
Blackpool	Coun. H. Brooks, J.P., chairman. Coun. Lumb, J.P., vice-chairman. Chas. Furness, general manager.
Bolton	Coun. J. R. Horrocks, chairman. Ald. A. Wilson, member of committee. J. Barnard, general manager.
Bradford	Ald. E. Priestley, chairman. J. W. Dawson, asst. engineer.
Brighton	Ald. J. Lintott, chairman. Wm. Marsh, engineer and manager.
Burnley	Coun. L. Thornber, chairman. Coun. W. Eastwood, vice-chairman. Henry Mozley, general manager.
Burton-on-Trent ...	A. B. Slater, general manager.
Bury	Ald. T. S. Collinge, J.P., chairman. Ald. H. Hargreaves, deputy chairman. F. Buckley, general manager.
Cardiff	Coun. Sidney Jenkins, chairman. Coun. E. Gough, vice-chairman. R. L. Horsfield, general manager.
Chester...	Coun. A. S. Dutton, chairman. Coun. A. Hart Davies, vice-chairman. W. H. Ellis, general manager.
Chesterfield	Coun. P. M. Robinson, chairman. R. H. Campion, general manager.
Coventry	Coun. E. O. French, chairman. Coun. J. I. Bates, vice-chairman. Coun. H. W. Wale, member of committee.
Croydon	Coun. A. A. Thompson, chairman. Ald. G. J. Allen, J.P., vice-chairman. T. B. Goodyer, general manager.
Darlington	J. R. P. Lunn, general manager. J. R. Fraser, traffic manager.
Darwen	Coun. G. Butterworth, chairman. G. A. Newsome, general manager.
Dundee...	Coun. J. G. Fraser, convener. W. T. Young, general manager.
East Ham	Coun. H. I. Rolf, chairman. Coun. H. N. Ridler, vice-chairman. W. C. Ullmann, engineer and manager.
Erith...	J. C. Williams, general manager.
Edinburgh	Coun. J. C. Morris Mancor, convener. R. S. Pilcher, general manager.
Exeter	Coun. F. Chick, chairman. R. O. Baldwin, general manager.
Glasgow	Bailie J. McWhirr, convener. Bailie R. Laing, sub-convener. Jas. Dalrymple, C.B.E., general manager.
Halifax...	Ald. T. Hey, J.P., mayor and chairman. Ben Hall, general manager.
Huddersfield	Ald. T. Canby, chairman. Coun. T. Woffenden, deputy chairman. A. A. Blackburn, general manager.
Hull	Coun. A. Digby Willoughby, chairman. Coun. C. P. Sherwood, deputy chairman. E. S. Rayner, general manager.
Ilford	Coun. G. R. Davey, chairman. Coun. A. Young, vice-chairman. L. E. Harvey, engineer and manager.
Ipswich	A. S. Black, general manager.
Keighley	Ald. A. Smith, member of committee. Ald. T. Houldsworth, member of committee. C. Jackson, general manager.
Kilmarnock	J. H. Menzies, general manager.
Leeds	Ald. R. A. Smithson, chairman. Ald. H. Brown, deputy chairman. J. B. Hamilton, C.B.E., general manager.
Leigh	Coun. J. Gregory, chairman. T. Smalley, general manager.
Lincoln	Richard Hoggard, general manager.
Liverpool	Ald. F. Smith, deputy chairman. Coun. J. Gordon, member of committee. P. Priestly, general manager.
London County Council	A. L. C. Fell, C.B.E., general manager.
Lowestoft	H. H. Saunders, general manager.
Maidstone	Ald. D. T. J. Lyle, J.P., mayor and chairman. A. T. Lambert, general manager.
Manchester	Ald. J. Bowes, chairman. Ald. A. W. Chapman, deputy chairman. H. Mattinson, general manager.
Middlesbrough ...	Coun. E. Turner, chairman. Ald. J Calvert, vice-chairman. H. G. Jeken, general manager.
Newcastle-upon-Tyne	Ald. R. Mayne, J.P., chairman. Coun. Sir A. M. Sutherland, Bart., K.B.E. Coun. H. A. Lawson, member of committee. Coun. G. G. Elliott, member of committee. Coun. W. V. Longfield, member of committee. E. Darnell, city treasurer. E. Hatton, general manager.
Newport	N. J. Young, general manager.

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Northampton	Ald. T. S. James, chairman. J. F. Cameron, general manager.
Nottingham	Ald. A. Turney, vice-chairman. Ald. J. E. Pendleton, member of committee. J. Aldworth, general manager.
Oldham	Coun. J. K. Cheetham, chairman. Coun. W. H. Sharpe, vice-chairman. W. Chamberlain, general manager.
Perth	W. Munro, convener. W. G. Snell, general manager.
Plymouth	Ald. Sir Thos. Baker, K.B.E., chairman. H. P. Stokes, general manager.
Portsmouth	Coun. Sir J. Timpson, K.B.E., chairman. Coun. E. H. Privett, vice-chairman. W. R. Spaven, general manager.
Preston...	Coun. J. Woolley, chairman. Ald. Ormrod, vice-chairman. J. F. Simpson, general manager.
Ramsbottom	S. Parsons, general manager.
Reading	Ald. C. G. Field, chairman. J. M. Calder, general manager.
Rochdale	Ald J. Taylor, chairman. Ald. H. Clark, member of committee. Geo. Webster, general manager.
Rotherham	T. P. Sykes, general manager.
St. Annes-on-the-Sea ...	Coun. A. E. H. Lee, chairman. H. W. Laing, general manager.
St. Helens	Coun. A. Rudd, chairman. L. C. F. Bellamy, general manager.
Salford	Ald. W. H. Barrett, chairman. Coun. H. S. Hind, deputy chairman. G. W. Holford, general manager.
Sheffield	Ald. W. C. Fenton, deputy chairman. Ald. J. Knowles, chairman, Engineering Sub-Committee. A. R. Fearnley, general manager.
Southampton	Ald. F. A. Dunsford, chairman. J. Dobson, general manager. Ald. W. G. Wylie, member of committee.
Southport	Ald. T. S. Richardson. Coun. J. Lloyd. T. J. Kendrew, general manager.
South Shields	Coun. J. G. Winskell, chairman. Coun. W. Stephenson, vice-chairman. Ald. W. G. Wylie, member of committee. J. C. Whiteley, general manager.
Stalybridge, Hyde, Mossley and Dukinfield Electricity and Tramways Board.	Ald. R. Wood, chairman. Ald. J. E. Rhodes, deputy chairman. Frank Schofield, commercial manager.
Stockport	Coun. T. W. Potts, O.B.E., chairman. Coun. W. Merrison, vice-chairman. A. T. Eardley, general manager.
Sunderland	Ald. G. New, chairman. Ald. W. Walker, vice-chairman. A. R. Dayson, general manager and engineer.
Tees-side Railless Traction Board	Coun. W. G. Grace, chairman. J. B. Parker, general manager.
Todmorden	Coun. S. H. Whitaker, chairman. J. Wild, general manager.
Wallasey	Coun. J. G. Storey, vice-chairman.
Walsall...	Ald. J. Cope, chairman. C. Burgess, general manager.
Walthamstow	Coun. B. Clarkin, chairman. W. Murray, general manager.
Warrington	Coun. W. Sutton, member of committee. Coun. F. Bolton. J. Telfer, general manager.
West Ham	Ald. G. Croot, Mayor. Coun. J. T. Husband. M. L. Slattery, general manager.
West Hartlepool ...	Coun. H. Salmon. T. G. Richardson, general manager.
Wigan	Ald. R. F. Fletcher, chairman. Ald. J. Walkden, vice-chairman. W. M. Milnes, general manager.
Wolverhampton ...	Ald. S. Cradock, chairman. C. O. Silvers, general manager and engineer.
York	Ald. W. C. Shipley, vice-chairman J. A. Bromley, general manager.
Guests	J. M. McElroy, C. J. Spencer, W. E. Freir, A. M. Willcox.

THE CIVIC WELCOME.

The twenty-first annual conference of the Municipal Tramways Association was held in the Lecture Hall of the Literary and Philosophical Society, Newcastle-on-Tyne, on September 13, 14 and 15. At the first meeting there was a civic reception by the Lord Mayor (Alderman R. H. Millican, J.P.) and the Sheriff (Councillor James Lunn), many other members of the City Council being present.

The Lord Mayor said: Mr. President, members of the Municipal Tramways Association, and ladies and gentlemen, it affords me the greatest possible pleasure to be at this gathering this morning to welcome your Association to this city. You are celebrating your majority on this occasion, and we are glad to know that you have honoured our city by having as your president during this conference one who, I am sure, has the respect of every member of the Association; that is shown by the fact that he is your president to-day. (Applause.) May I say that what you think of Mr. Mayne outside, we think of him inside. We, as a municipality, have recognised what Alderman Mayne has done during the past few years in our own city with regard to our own tramways undertaking, and we take the compliment that you have paid him in appointing him your president as a compliment also to our own city. I think it is very appropriate that your Association should celebrate its majority in the northern metropolis, because you will be interested to know that tramways were really initiated and developed within six or seven miles of our own city 109 years ago. That may be news to some; it possibly was to me, but Mr. Beckett was good enough to give me the information, and it is absolutely true that the first tramway system was initiated at Killingworth by George Stephenson, and since that time there have been developments of an extraordinary character. It has been sometimes suggested to me that the name "tramway"—many of us do not know how it really originated—was derived from the late Sir Bey Outram, but from inquiries that have been made I find that is not so, and that the word "tramway" was used before his time. It was derived from the word "trammel" ways or "confined" ways. However, there have been, as I say, wonderful developments in the tramway world. The figures that have been put before me are really amazing and extraordinary. I find that last year there were 4,860 millions of passengers carried on the tramway systems in our own country, most of which, of course, as you are aware, are municipal tramways, but when you come to realise the amount of money that was taken, in copper, in pennies, possibly in some cases even less—in our own city we have a halfpenny fare—the figures seem to be so extraordinary that we can hardly realise the extent of the movement. There is no doubt about it that the tramway has become a national necessity. (Hear, hear.) Now I want to congratulate you upon the wonderful success of your Association. It has played a very important part in the last few years in the history not only of our country, but, I venture to say, of our own particular citizens and towns. You have had many difficulties in the past with regard to the tramway movement, and you no doubt are bound to have difficulties in the future. You cannot help it with a big organisation such as this, with such vast interests to deal with. You are bound to have difficulties cropping up now and again; and there, I think, is where the value of this Association comes in. You have our good wishes for the coming year. I believe there is a difficult time for all such movements in the coming year as tramways and other municipal efforts, and generally throughout the country. To me the coming year seems to bristle with difficulties. There are financial, labour and industrial problems, and really no one knows more or sees more of what goes on in the life of a city, and has to look forward to these things, more closely than the man who, for the time, occupies the position that I have the honour and pleasure of doing this year. (Hear, hear.) I understand that this is your Association's first visit to Newcastle, and I am indeed glad, as I say, to welcome you, the more particularly when I realise that my very old friend, Alderman Mayne, is the president. I offer you on behalf of the Corporation—we have the Sheriff and many member of the Town Council present—a very cordial welcome. My only regret is that your visit is so short that you will not be able to see the many things we have to show you. But you have not exactly come to have a happy time; you have come to deal with the business of your great Association. On behalf of the municipality, and on behalf of the city, I offer to you a very cordial, a very sincere and hearty welcome. May our friends leave us with a very happy feeling as to the people of "canny Newcastle." (Loud applause.)

The President (Alderman R. Mayne): I knew very well that when you came to Newcastle we should have a Lord Mayor who would convey to you the sentiments of the city in reality. The Lord Mayor has, by his grace and kindness, offered a welcome to the individual and also to the whole Association. The Lord Mayor has paid us the further compliment that in spite of the business to which he has to attend, he is going to remain awhile. (Applause.)

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PRESIDENTIAL ADDRESS.

By Alderman RICHARD MAYNE, J.P.
(*Chairman Transport and Electricity Committee, Newcastle-upon-Tyne Corporation*).

To-day we celebrate the twenty-first anniversary of the formation of this Association. It is a pleasure to know that some of those gentlemen who first formed themselves into an unpretentious organisation for the advancement of the interests of the undertakings they represented are still connected with us. A preliminary meeting was held on March 1, 1902, when there were present—Mr. Young in the chair, and Messrs. Aldworth, Baker, Bellamy, Fell, Hatton, and McElroy. From that meeting sprang the Municipal Tramways Association, and to these gentlemen we are largely indebted for our nurture, our preservation, and our progress.

Out of a total of 102 municipally operated tramways 95 are now in membership with this Association.

From an appendix to the annual report you will see how much voluntary effort of a high order has been put into the common stock during the past year, and it is my duty and privilege to express the warmest appreciation of this Association of the efforts of all the gentlemen who have contributed to our common interests during our youth and adolescence.

During the past year it has become an insistent custom in some quarters, which are not suspect of altruistic motives, to declaim against tramways undertakings and assume that they are a sort of spent force, and have had their day. We need not pay too much attention to criticism of that character, nor indeed to any critic who deliberately shuts his eyes to the facts. It may, however, serve some useful purpose if at this Conference I indulge in a short survey of the past, and deal with the present position. It is now 57 years since public tramways were first operated in this country, and the honour of that adventure belongs to the historic town of Portsmouth, which is so ably represented by the vice-president of this Association, Sir John Timpson. They were introduced by private enterprise into that town in 1865, two years after the first local Act authorising the construction of tramways was passed, but 29 years elapsed before Glasgow and Leeds led the way, in 1894, in the municipal operation of tramways. The following is an interesting statement of the twenty-one towns which were the pioneers of the movement, and you will observe with interest the time that elapsed in each case before the undertakings were taken over by municipalities.

In this connection it is interesting to recall the fact that in the early days of tramway enterprise Parliament authorised municipalities to construct tramways, but did not confer upon them the powers to operate them.

NAME OF TOWN.	Date of First Local Act, Confirmation Act, or Provisional Order authorising the Construction of Tramways.	Date when Tramways were first operated.	Date when Tramways were first operated *by the Local Authority*.
	Year.	Year.	Year.
Portsmouth	1863	1865	1901
Liverpool	1868	1869	1897
London	1869	1870	1899
Glasgow	1870	1872	1894
West Ham ... ... (North Metropolitan)	1870	1870	1904
Leeds	1871	1871	1894
Edinburgh	1871	1871	1919
Greenock	1871	1873	Still operated by Company
Aberdeen	1872	1874	1898
Belfast	1872	1872	1905
Dundee	1872	1877	1899
Sheffield	1872	1873	1896
Southport	1872	1873	1900
Dewsbury	1873	—	—
Middlesbrough, Stockton, and Thornaby ...	1873	(Facts not a scertained	
Newport	1873	1874	1901
Manchester	1875	1877	1901
Salford	1875	1877	1901
Newcastle-upon-Tyne ...	1877	1878	1901
Nottingham	1877	1878	1896
Southampton	1877	1879	1898

It is not my intention to trouble you with many figures, but the occasion is appropriate to observe the growth of the tramways systems of the country. The following is a statement of the capital outlay upon tramways and the number of passengers they carried at intervals of ten years since 1881.

Year.	Capital Expenditure.	Number of Passengers carried.
	£	
1881	6,940,000	205,624,000
1891	14,163,000	565,621,000
1901	26,799,000	1,198,227,000
1911	75,673,000	2,907,177,000
1921	86,142,000	4,863,968,000

Of the capital outlay in 1921 there had been incurred—

By Local Authorities	£62,293,000
By companies	23,849,000
	£86,142,000

Of passengers, there had been carried during 1921—

By Local Authorities	3,949,138,000
By companies	914,830,000
	4,863,968,000

In common with all other industries, this industry has experienced the aftermath of the war, as the following statement by the Ministry of Transport shows, viz.—

> "In 1920-21, tramway undertakings received £939,004 from local rates, and contributed in relief of such rates £53,594. In 1913-14, they received £62,600 and contributed £589,886. . . In spite of the increased fares the ratio of working expenses to receipts rose to 86·49 per cent. as compared with 80·55 per cent. in 1919-20. In 1913-14 the ratio was 64·35 per cent."

It is obvious that tramways have met a great public necessity. That they continue to do so is beyond question. No one can well conceive the inconvenience and loss to the community that would happen if by some catastrophe they were suddenly blotted out and ceased to be. It is commonly recognised, I think, that the vehicle has yet to be devised that can compete successfully with them in carrying our industrial population by means of a regular service at low fares on equal terms, especially in relation to the burdens of rates, taxes, and maintenance that they have to carry. I do not hesitate therefore to proclaim the continued public necessity for tramways, nor to affirm with emphasis that on equal terms they can outstrip with ease all their rivals and competitors.

This is not saying that we are blind to the needs nor deaf to the calls of a policy adapted to the widely diverse conditions that exist throughout the country. For example, Bradford and Leeds pioneered trackless trolley systems for some of their routes in 1910. Since then others have emulated their example. The adoption of this method of passenger transport seems to have been influenced in many cases by a desire to escape present capital cost on renewals or extensions, and by the determination to escape the heavy burdens thrown upon tramways for permanent way maintenance and local rates. We shall all watch the result with interest. It is clear that the cost of road maintenance will be materially affected by that course, but the incidence will be shifted to other shoulders. So also will that of the local rates. These remarks naturally lead to a consideration of the question which has often been discussed at these conferences, namely, the progressive increase in the cost of road maintenance thrown on tramways. It is one that has again occupied the consideration of the Council during the year.

At the recent Congress of the Institute of Transport, Sir Henry Maybury said, in moving a vote of thanks to the reader of a paper on "Finance of a Modern Highway—A Problem and a Solution"—

> "It is suggested that some forms of transport were being subsidised at the expense of tramways. That was only partially true. Circumstances had altered since the passing of the Act of 1870, and he agreed that there would now appear in equity to be a case for the tramways undertaking against the ordinary commercial user. In his official capacity he had been asked to receive a deputation from time to time from the Municipal Tramways Association, but he suggested that as Parliament had put the obligation on them they should go to Parliament for relief, and officially he would not be against them. If the tramway undertakings were to be relieved from the obligation which Parliament had put on them, then they should be brought into a scheme of taxation, and a charge should be made on the

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seating capacity of the tramcar; the track, which was now the responsibility of the undertakers, being transferred to the highway authority. Some such suggestion as that would probably meet the case, but it ought to mean and must mean concerted action on the part of the tramway undertakers themselves, and would not come from a Government department."

This is a very emphatic pronouncement. It seems to point the direction which this Association must take in order to obtain redress; and it may be necessary for us to take action by means of a Private Bill and fight out the issue in the House of Commons.

You know full well, but I am afraid the general public do not realise that before a municipality obtains power to carry on a tramway service onerous obligations are placed upon them with regard to—

The operation of workmen's cars at cheap fares.

The regulation of rates of fares of passengers, both ordinary and workmen.

The necessity for some continuity of operation in the interests of the community.

The obligation of the undertaking to defray all the costs of maintenance of the permanent way, in addition to the original cost of its construction.

The local rating of such permanent way as a rateable hereditament for the purpose of local taxation.

The operation of tramways along both profitable and unprofitable routes, and at profitable and unprofitable times of the day, in the interests of the travelling public.

Some of these obligations are justified, our first duty being the provision of adequate facilities for transit from point to point in our city or area, but some of our associated authorities are faced with competition from other forms of transit on which no obligation for the public need is imposed, and who are required to pay no more than the amount of the excise licence imposed by the Finance Act of last year, and the local rates upon their depots, which may or may not be located within the area of the local authority in which the competitive omnibuses operate.

The immunity enjoyed by road passenger transport competitors from the weight of the burdens carried by railed-traction stands out in sharp and striking contrast, but—and this is the irony—we have to maintain and construct roads for them. The main reasons why the road obligation was, in the first instance, imposed upon tramways were because it was held (1) that tramways would have a monopoly of street traction free from any competition, and (2) that the fares would be such as would cover the then moderate price of making and maintaining the permanent way. But when electric superseded horse traction, the obligation was continued, notwithstanding the fact that no direct wear and tear of the road surface resulted from that new form of traction. These are moving reasons why there should now be reconsideration of the old incubus, and why Parliament should be pressed to remove a manifest injustice. Add to these, that under the Roads Act tramways are in no sense, apparently, to be considered a monopoly, and our case is complete. This question loses nothing of its importance, and the Executive Council have requested Mr. Mattinson, Mr. McElroy's successor, in spite of his own reluctance to take a prominent part in this conference, to submit some notes on the subject by way of opening a discussion.

We have never claimed a monopoly, but we have asked for and do claim either a freedom from exactions not placed on other passenger transport systems, or that the same exactions be placed on all who use our streets and roads in competition with us. The latter I think the better, for if the "exactions" are in the public interests they are desirable from company or corporation—from tramcar or omnibus. But an amazing development has taken place during the past year. A proposal was made by the London Underground Group for the extension of the underground railways at an estimated cost of £6,000,000. Lord Ashfield stated the case in *The Times* newspaper of October 29, 1921, in the following terms, viz.—

"The raising of £6,000,000 for the purposes named by the offer of a gilt-edge security, the interest on which will be guaranteed by the Government, though with the certainty that the Government will not be called upon to find any money.

"The guarantee of reasonable security by the Government that the omnibus services operated by one of the Group will not be submitted for ten years to the competition of 'piratical adventurers' who run a few omnibuses on profitable routes at profitable times, without contributing anything to the solution either of the traffic problem or the unemployment problem."

Two years before, when giving evidence before the late Mr. Kennedy-Jones' Committee of the London traffic problem, the witness representing this Group said—

"Our companies, as I say, have sought a monopoly position in connection with traffic in London."

This lofty claim was supported in the press by a representative of the National Union of Railwaymen, who said—

"In my judgment, being reproductive expenditure, the scheme is far more justifiable than many of the schemes which have been mooted by politicians. From the railway point of view, Lord Ashfield's scheme will afford further important traffic facilities which should make for considerable employment, and in proportion to its prosperity decent conditions of service. Obviously, if the railway companies are prepared to risk capital in the construction of something for the public advantage, it would be unfair to permit their enterprise to be taken advantage of by others, and in common justice reasonable safeguards should be granted to the companies."

It is not necessary for me to add anything to this statement if we substitute the word "tramways" for "railways." It is important, however, to point out that something like a new principle has been imported into the finances of non-publicly-owned transport service by this move. On June 24 last the companies did issue £2,500,000, 4½ per cent. redeemable second debenture stock (1942-1972) at 94 per cent., with both principal and interest guaranteed by the Government. It is a trustee investment. There is on obligation imposed upon the companies to make any provision to redeem the stock by means of an annual charge for redemption; moreover, interest will be charged to capital during construction. There is no provision or indication in the prospectus that with this Government security there is to be any Government control.

It was in the belief that the public interests are, at any rate, not inferior to those of a private company, that the Metropolitan Municipal Tramways Council quickly turned their attention to these proposals. I will quote from a statement they issued—

"The effect of a Government guarantee of the nature indicated would inevitably result in placing the municipal undertakings at a still greater financial disadvantage, by permitting the Underground Group to subject municipally-owned tramways to a subsidised competition by their omnibuses.

"We submit that every argument that has been used so far on behalf of the Underground Group applies with greater force to the municipal tramway undertakings, which are operated

Alderman R. Mayne, J.P.

President of the Municipal Tramways Association 1921-22.

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for the benefit of the public, without any reference to the amount of profits to be derived from them, and, indeed, altogether in the interests of the community. It is our purpose and duty to carry on a great public utility service as efficiently as possible, and at as near cost price as possible.

"Like all other industries, tramway undertakings are now struggling against the effect of post-war conditions, which have produced an enormous increase of wages and the cost of material. We have, in fact, found it impossible to adopt an economic fare during the last year or two to yield sufficient revenue to cover the 'all-in' cost of operation, and it is at the present time, when brighter prospects are before the tramway authorities, so far as some reduction of expenditure is concerned, that this scheme is launched, partly as a commercial proposition, and partly as a benevolent enterprise to provide work for the unemployed. We submit that these two propositions should stand apart, and that no such monopoly should be granted to any private undertaking."

The brief history of the Bill brought forward by the North-Western and Midland Group of Railways to obtain authority to carry both goods and passengers on the roads apparently without any restrictions also brings forcefully home to us the trend of the times, and throws much light on some of the problems that confront local authorities.

Road transport competition and big schemes of road widening and adaptation to heavy modern mechanical vehicles, which are not adapted to many existing roads, the fierce progress in the wear and tear of roads, the character and the measure of taxation upon mechanical road vehicles—these are subjects with which the financial interests of all local authorities are closely bound up.

They raise issues of overwhelming importance; they affect seriously the oppressive burdens of local taxation; they bear directly upon the interests of the members of this Association, but even they do not throw into true perspective the vital difference between a pirate or vagabond service of passenger transport, which is out in fine weather and at favourable times, and in when it is wet and unfavourable, and a regularised and efficient service, operated all the time at the lowest possible cost for the public advantage.

Engaged as we are in operating a publicly-owned passenger service, concerned only with efficiency and cost price whenever we can get it; not impelled or stimulated by motives of profit, we fear no competition under fair conditions, and, if nothing short of monopoly can secure to the community a self-sustaining and efficient service, then, on broad grounds of public policy and in the public interests, we place our claim as high as that of a monopoly.

Before concluding my remarks I should like to commend to the careful consideration of tramway authorities the subject of Unemployment Insurance in the industry. A subject which is now receiving careful investigation by your Executive Council.

It is estimated that as employers we contribute £114,000 per annum to the Government scheme—the employees' contribution amounts to £102,000 per annum. It is also estimated that the amount received in benefit in a year is not more, at the very outside, than £63,400 (I speak in round figures). Thus this industry is contributing to other industries whose unemployment is greater £150,000 per annum. The official returns set the average unemployment in the tramway industry at 4 per cent., and over all industries at about 15 per cent.

On February 22 last the Minister of Labour issued a letter in which he said that "it remained the policy of the Government to do everything possible to encourage industries to administer their own schemes for dealing with their workpeople who became unemployed," and I have no doubt that to accept this encouragement and provide a "special scheme" would be sound and economic policy on our part.

An objection possibly may be raised that what we failed to contribute towards the less favourably situated trades would have to be made up from the pockets of the taxpayer, but if by reason of seasonal or other causes peculiar to an industry its employees could not be kept at constant work, their unemployment insurance should be a charge on the article produced or service rendered, and not be subsidised by another industry.

In January last the first issue of the *Journal* made its appearance. I think it is an acceptable publication generally. The Executive Council hope that it may become a useful medium by which members may be informed of what we may call the internal movements of the industry, and the co-operation of all the members is invited to that end. The editor devotes some time (and considerable talent) to it, and he has a right to look for general assistance.

We have lost by death during the year a most estimable colleague in the late Alderman Sellers. He was a very devoted member of the Executive Council, and his place was never vacant. I am sure you will all deplore greatly his death.

Of Mr. McElroy, who has retired from the position he has adorned for so many years in Manchester, I hope to have an opportunity of saying something on another occasion during this Conference.

The Association has attained its majority at a period in the national history which calls for the qualities of full development. It depends upon its personnel—its individual members—and from them we look for the exercise of the virtues of vision, conviction, and courage to carry on the public service for which they are responsible. I ask you now to enter into full, frank, and friendly discussion of the questions to be considered at this our twenty-first annual Conference.

Mr. J. B. Hamilton, C.B.E. (Leeds): I listened with very great pleasure to the presidential address, and thought that I had never heard an address showing such clear vision or containing such lucid observations as those made by the president. I feel sure therefore that in asking you to give a very hearty vote of thanks to the president for his very characteristic address, I shall have your warm support. Mr. Mayne during his year of office, as he said of his late lamented colleague, never had his seat vacant at a Council meeting. He has attended with assiduity and with great knowledge and ability all the meetings of the Council during one of the most troublous years we have ever had as an Association. His address marks, I think, the very high state which the presidential work of this Association has reached. I therefore ask you to accord him a very hearty vote of thanks for his address to us to-day.

Alderman S. Craddock (Wolverhampton): I have great pleasure in seconding the resolution which has been so ably proposed by Mr. Hamilton.

The motion was carried with acclamation.

Sir John Timpson, K.B.E. (Mayor of Portsmouth): The Lord Mayor is now leaving us, and I think we would be wanting in our duty if we allowed him to leave without thanking him for his very hearty and sincere welcome to us this morning; and in your name I wish to move that a very hearty vote of thanks be accorded to him. We appreciate the privilege of discussing our problems in Newcastle, and we appreciate what the Lord Mayor has said about the work of our Association, and also with regard to the social side of our meeting. We feel sure that after our visit to this city of Newcastle we shall go back with very happy recollections of it.

Mr. A. L. C. Fell (London): I have great pleasure in seconding the motion, which should also include the Sheriff, because we are delighted to be received both by the Lord Mayor and the Sheriff. I know in the past, when members of the Association have come to Newcastle, we have always received the warmest reception, and we have always learned something, and I am sure on this occasion we shall do the same. I have much pleasure in seconding this resolution.

The vote of thanks having been heartily accorded,

The Lord Mayor said: It is always a pleasure to Newcastle to welcome conferences such as yours, and you will readily appreciate what an additional pleasure it has been for the Sheriff and myself and many of our colleagues whom I see sitting around me to have been with you this morning, when one of our own, and one of my very dear old friends, is the president. (Applause.)

The Lord Mayor then withdrew.

The President then called on Mr. Ernest Hatton, who read the following paper.

AN ARGUMENT FOR THE "PENNY FARE"
DEMONSTRATED BY ACTUAL EXPERIENCE.

By ERNEST HATTON
(*General Manager, Newcastle-upon-Tyne Corporation Tramways*).

The question of fares is again engaging the serious attention of tramway authorities. Due to the rapid advance in working expenses increased fares or a revision of existing fares became necessary. Some undertakings adopted the minimum 1½d. fare, whilst others, going still further, introduced 2d. minimum fares, and thus got back into the early days of horse traction, but the tendency now is to revert to the 1d. fare, and this is as it should be.

Now, however long a distance may be given for a high minimum fare, it places the tramcar beyond the reach of many, and in the case of a large household of children places a severe burden upon that family, and is a practice altogether out of keeping with the arguments used by the promoters of municipal traction services in the "nineties."

The tramcar is the poor man's motor; it therefore follows that to be of constant service to him the scale of fares must be well within his means, and as low as is consistent with the financial safety of the undertaking.

A table of fares and a diagram are submitted of the alterations to same to meet the financial requirements of the Newcastle system, and a detached route is chosen to illustrate the changes in the simplest form. It is also thought desirable to review what was formerly done.

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A Typical Route.

	Passengers	Distance	Receipts
1905			
2d. fare ...	2,000	4,000 lin. yds.	£273
1½d. ,, ...	9,300	2,900 ,,	
1d. ,, ...	46,000	2,250 ,,	
*½d. ,, ...	3,200	2,250 ,,	
	60,500	Traffic costs to gross receipts	36 per cent.
1907			
1½d. fare ...	6,200	4,000 lin. yds.	£277
1d. ,, ...	55,600	2,800 ,,	
*½d. ,, ...	3,800	2,800 ,,	
	65,600	Traffic costs to gross receipts	26·68 per cent.
1917			
1½d. fare ...	15,300	4,000 lin. yds.	£500
1d. ,, ...	85,000	2,800 ,,	
*½d. ,, ...	24,100	2,800 ,,	
	124,400	Traffic costs to gross receipts	30·37 per cent.
1922			
1½d. fare ...	70,000	4,000 lin. yds.	£664
1d. ,, ...	51,400	2,000 ,,	
*½d. ,, ...	5,600	2,000 ,,	
	127,000	Traffic costs to gross receipts	46·7 per cent.

* Children's and terminal fares.

In 1905 the traffic expenses were 36 per cent. of the gross receipts and the undertaking was only just making ends meet.

By 1907 the traffic expenses had been reduced to 26·68 per cent., and the undertaking was placed upon a good footing.

It was then decided to reduce the fares, and the tables 1905-07 will show the result, from which it is evident that so long as there are no violent fluctuations on either side of the accounts there is considerable latitude in arranging the fares, and generally speaking by keeping the long distance fare low and giving a good ride for 1d. the better the result.

On referring to the table for 1917 with the 1907 scale of fares still in operation, it will be seen how the traffic had developed during the period of great stress; it subsequently reached higher figures, but 1917 is taken as an illustration.

A large increase in passengers is there shown due to the introduction of ½d. half-mile terminal fares at both ends of the route. The percentage of traffic expenses to the then receipts was 30·37 per cent., and whilst higher than previously the system could well carry the increase at that date.

It was at a later date, 1920, when the percentage of expenses had increased so heavily that a change in fares became necessary There were many advocates of 1½d. minimum fares, and advocates of higher fare values for the long distances.

Undoubtedly we could at that time have easily obtained 1½d. minimum fares, and allowing a fair margin for reduced traffic as a result, from the date of the alteration, May 13, 1920, to June 30, 1922, £310,000 more could have been taken from the public by the tramways system. There were, however, very good reasons at the time against 1½d. minimum fares, and so after much opposition the present scale was adopted.

The principal change was in the curtailment of the 1d. distance from 2,800 lin. yds. to 2,000 lin. yds., or thereabouts, giving no overlaps and leaving all other fare values as before with the exception that the ½d. terminals were withdrawn, but the children's ½d. fares still remained; also a ½d. fare in the centre of the city to balance up fares over the centre city zone.

The revision was calculated to produce £65,000 to £70,000; as a matter of fact it actually produced £80,000 at the time.

If no further rise in expenses due to increased wages had taken place this additional revenue was ample for the purpose, but subsequent increases in the expenses took place when wages in other industries were already falling, and thus absorbed the whole £80,000.

There were again advocates of 1½d. minimum fares, but as a general fall in values had now set in it was seen that this was no policy to pursue, and that a general reduction in working expenses was the only remedy.

However, owing to the wages being governed by a scale decided upon between the representatives of the tramway industry and the workers, adequate reductions could not be brought about at the time.

The Newcastle authorities then decided to withdraw from the District Councils and the Wages Agreements, and as considerable reductions were already foreshadowed and are now taking place in the rates of skilled workers in other industries, it is difficult to see how tramway workers are going to be singled out to remain at the present wage level whilst traffic receipts are falling due to lack of employment generally. It would be a preposterous condition that the workers who use the cars should subsidise the workmen on the cars, and a general fall in expenses will have to take place to meet the falling revenue.

During the whole of the period nothing has been done on the Newcastle system to choke off the long-distance rider, and thus faith has been kept with the promises made when the system was inaugurated; whilst the 1d. and ½d. riders (and they are still 40 per cent. of the whole) have a quick service where the cars converge on the centre of the city, and at the same time a very reasonable distance given for those values. It must not be overlooked in comparing fare values that a person living a 1d. fare stage can get four rides per day for 4d., morning, twice noon, and evening; whereas the 1½d. passenger gets only two rides for 3d., say morning and evening. If homeward bound at noon he then pays another 3d., riding in and out, or 6d. per day.

Now, there are amongst us advocates for altering the value of 1s. by legislation; I am not one of these—conditions now, as at all times, must shape themselves to suit the nation's coinage, and not *vice-versa*. It is not likely that I shall be called upon to run the finances of the country, but I will at once state that I should be quite prepared to do so without ever contemplating altering the coinage, and the only safe method to follow is to cut down all unnecessary expenditure, however attractive it may be at the moment to be sympathetic.

It appears to me with reasonable reductions in wages following in line with other trades that we can still give a reasonable "penny ride" and cover our cost, and after all what is the use of having a penny coin if something cannot still be purchased by it?

One thing is certain, that the great increase in traffic following the introduction of electric traction was not gained by increasing fares, but rather by the reduction of fares and giving quick services, and if expenses are watched and this policy still pursued we shall eventually pull through all right.

There is no doubt that fixing fares without regard to the capacity and willingness of the travelling public to pay them is fatal to good results, and it should not be forgotten that we are dealing with monopolies; therefore the 1d. fare distance should not be less than that laid down by the early Tramway Acts.

It may be these views are not acceptable to the majority, but I am sure that the material given will produce a discussion of some value to the industry.

DISCUSSION.

Mr. A. Baker (general manager, Birmingham Corporation Tramways): Mr. Hatton at the end of his paper suggests that his views may not be acceptable to the majority of those present here to-day, and in that I heartily agree. (Laughter.) Indeed, I shall be very much surprised if there are more than half a dozen misguided persons in this room who have carefully studied the paper who can say that they agree with it in its entirety. If you get to the vitals of the paper you find that the writer advances the thesis that it is essential that tramway fares should be brought down presumably to pre-war level, and that the only way to accomplish this is by a general reduction of working expenses. Mind you, no matter to what level the receipts may sink due to trade stagnation and other causes, operating expenses must be cut down to the same level. Now when one remembers that wages represent from 60 to 65 per cent. of the total operating costs, it will be seen that to reduce fares to pre-war level he would find it necessary to reduce wages also to pre-war level or even lower. It is true that tramway men to-day are getting 130 to 140 per cent. more per hour than in July 1914, and it is equally true that, compared with some other industries, tramway men are getting something above market value for their labour, and doubtless reductions will have to take place. This, however, is being dealt with by the National Joint Industrial Council, and I think it may be fairly left to that body to deal with on your behalf. But does anyone imagine that wages will ever come back to pre-war level? (Cries of "No, no.") I for one do not, and indeed I will go further and say I hope not. (Hear, hear.) The worker is undoubtedly entitled to a higher standard of living than he enjoyed in 1914. (Hear, hear.) In fact, this was recognised by those who represented the industry in the arbitration proceedings in 1920, when the datum figure of 135 was fixed. It will be remembered that it was agreed that wages should rise or fall 1s. for every five points from the datum figure of 135. The bonus at this time was 43s. per week. This meant that when the cost of living came down to zero, as it were, further reductions

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would cease, and that tramway men would be left with something like 15s. or 16s. per week more wages than in 1914, and that was to represent the higher standard of living. I suppose that Newcastle employs probably 1,000 men in running its tramways, probably more, and the wages bill in respect of this agreed increase represents upward of £40,000 per annum. Does Mr. Hatton say that he can pay these additional wages on a pre-war scale of charges? If he does, I can only assume that his pre-war fares were grossly excessive. But I do not see any great signs of liberality with regard to distances allowed in Newcastle for a penny. If you look at the schedule you will see that in 1905, when many other tramways were allowing 2¼ to 2½ miles for 1d., Newcastle gave slightly over a mile and a quarter. It now gives 1⅛ miles for a penny. At its best it never gave more than a mile and a half for a penny. But as a matter of fact tramway fares have generally been too low to allow of sufficient margin to provide against emergencies. The result is being felt by many undertakings to-day, some of which are practically bankrupt and many are receiving subventions from the rates. (Hear, hear.) In consequence of these low fares, when the pinch came nearly every tramway undertaking in the country had to revise their charges upwards, so that the selling price of the article they had to offer, viz., the ride, bore some relationship to the cost of producing it. Even Mr. Hatton had to do it, for he tells us on pages 5 and 6 that in 1920 Newcastle fares were revised chiefly by the curtailment of the penny fares, and that the revision brought in something like £80,000 additional revenue, £15,000 or £16,000 more than he actually estimated. But even that was not enough, and owing to further increases in operating costs this £80,000 was completely obliterated. But having tried this method of increasing his revenue, and on his own showing finding it was successful, he says this raising of fares "was no policy to pursue," and that a general reduction of working expenses was the only remedy. Mr. Hatton goes on to say that "owing to the wages being governed by a scale decided upon between the representatives of the tramway industry and the workers, adequate reductions could not be brought about at the time." The Newcastle authorities therefore decided to withdraw from the District Council and wages agreements, and in effect they are going to be "a law unto themselves." In other words, they are going to introduce cheap fares, and the wages of the workmen are to be brought down to such a level, quite regardless of economic conditions, as will enable the undertaking to carry passengers at pre-war prices, but I venture to suggest that Mr. Hatton has set himself an impossible task. If this is really his case, I do not envy his position in Newcastle. (Hear, hear.) I really think he cannot mean it, and that he only did it for the sake of setting up an argument. Tramways, as we all know, have got to be self-supporting. They cannot be allowed to be a charge on the rates—(hear, hear)—but they cannot, in my opinion, ever be made to be self-supporting by sweating the workmen—(hear, hear)—or by bringing wages down to such a point as will bring the employees below the poverty line, as the demagogues call it. There is only one way, in my opinion, to make tramways self-supporting, and that is to make the passenger pay for the cost of his ride. (Hear, hear.) He has no right to travel at less than cost. He must be charged the cost of the full operating expenses, including depreciation and the charges on capital outlay. Of course working expenses must be brought down to bed-rock. There must be no extravagance, and improved methods must be adopted wherever possible, but I venture to say that the suggestion that tramway fares can be brought down to pre-war level by the methods adopted by Mr. Hatton, and suggested in his paper, is as fallacious as it is pernicious.

Mr. W. Murray (manager, Walthamstow): I have heard Mr. Hatton's paper read with great interest, because the question is of vital importance to every tramway man; and I know it will provoke an interesting discussion because of the divergence of opinion with regard to this matter. Since I have heard Mr. Baker, I am confirmed in my idea that we are not likely to agree on this matter. I do not agree with either of them. (Laughter.) Mr. Hatton's ideas may be quite good for Newcastle-on-Tyne, but he cannot possibly lay down any rule which will be applicable all over the country. Local conditions differ very much. We all know that at one time Glasgow for many years set the fashion with regard to halfpenny fares, and were amply justified in doing so. Some of us tried to follow their example, with, to put it mildly, most unsatisfactory results. A penny fare may be the ideal fare in Newcastle-on-Tyne, but it may be altogether inadequate in Walthamstow or Burton-on-Trent, or Exeter, or elsewhere. I say it deliberately, that no rule can be devised which will establish an equitable basis upon which to determine tramway fares all over the kingdom. Mr. Baker, in his reply to Mr. Hatton, said that we are all agreed that tramways ought to cover their own costs and be made to pay their way. I do not know that we are. (Cries of "Oh!") There are three schools of thought in existence with regard to tramway matters. Mr. Baker represents one, which argues that tramways ought to be run on purely commercial lines—(hear, hear)—that the man who rides ought to pay sufficient to meet the working costs, repayment of loan and interest, and set aside sufficient for depreciations, renewals, etc. (Hear, hear.) That is one school of thought. There is another school of thought which has in recent years entered municipal life, and is growing in numbers and in influence; and that consists of men who have ideals, and who say that man is of more importance than money. They say that the men, women and children who live in a district ought to have first claim; that slum property, insanitary conditions, overcrowding, and the present depressing environments ought to be swept away; and that tramways ought to be used in order to carry the people further afield, where they can live under better conditions, can live a more happy, a more clean, and a more holy life than they can possibly do, many thousands of them, under present conditions; that tramway fares ought to be fixed sufficiently low to be within reach of the poorest of the people; and that, generally, the health and happiness of the community must come first. That is the second school of thought. Then there is a third school of thought, very small in number, but also growing in importance, and that school says that tramways are a vital necessity to the well-being of a community; are as important as public parks, or libraries, or fire brigades, or sewerage schemes; and that therefore they should be made a direct charge on the rates, and be run absolutely free. (Loud laughter.) Of course they know that the mere suggestion of such an idea will evoke laughter, ridicule and contempt, and even in some cases anger; but their reply is that this is a common experience when any great reform is advocated. They tell us, and it is true, that when free education was first mooted there was a storm of abuse poured on those who made the suggestion; and it was argued to be unfair and immoral that the old maid and the bachelor should be called upon to pay for the education of other people's children. But to-day no one would seriously suggest that the step then taken was a mistake, or that we should go back to the old conditions. I am not allying myself at the moment with any one of these three schools. (Laughter, and a voice: "Then there must be four.") I do not suppose I shall live long enough to see the change, but I do say that some of the young men to-day engaged in the tramway industry may; and I will say this, that when the change comes about no man will have cause to be more grateful for it than the tramways manager.

Councillor H. W. Wale (member, Coventry Tramways Committee): So far as I understand the position, if the tramways of the country were to be run as a whole, then you might do what Mr. Murray suggests, but so long as we are bound by present legislation and the powers which we have ourselves obtained from Parliament, it seems to me that there is no earthly reason why tramways should not be put in the position of being made to pay, and at the same time give proper service to the community. It is absolutely idle to talk of ideals in present circumstances. We know perfectly well that the case put before the Industrial Court was that tramways should be made to pay, and even Mr. Bevin, with his great eloquence, never dared to put the position that tramway undertakings should not be made to pay. On the contrary, the representatives of the employees associated themselves with us in saying that the tramways should be made to pay, and it seems to me that the only hope for us is that every municipality that owns a tramway undertaking should do its very best to make it pay, and not attach too much importance to what other municipalities are doing. It seems to me that every tramway undertaking has its own peculiar problems, and it is the duty of those running that undertaking to do their very best to make it self-supporting. If they were to do as Mr. Murray suggests, and put the cost of tramways upon the rates, they would be deviating from thir duty. Obviously, if you appeal to the great majority of the ratepayers in a city, they will not look at any proposals which are likely to put further burdens on them. We have to recognise that the rates to-day are very much higher than they have been in the history of municipal legislation; and, further, from a business point of view, I suggest it is not wise for us to do anything but the square thing by the people who have put up the capital, by the people who are operating the service, and also by the people who are using the cars.

Alderman C. Higham (chairman, Blackburn Corporation Tramways Committee): I have no intention of entering very fully into the discussion as to whether a universal penny fare is possible or not, because I hold the opinion that you cannot possibly lay down a rule that would apply to every tramway authority. What might do in Newcastle would certainly not do in Blackburn, and I am positive that there are very few of the smaller undertakings that can afford to have a penny fare with present running costs. It is absolutely impossible if they are going to be run as a commercial concern. Furthermore, I do not intend to enter into any argument as to whether we should run tramways on a sentimental basis or

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a commercial basis. (Laughter.) I do not think that is the object of the paper, but there is one paragraph in the paper that I take exception to, as a humble member of the Industrial Council. After pointing out that the amount raised by the revision of fares (£80,000) was not sufficient to cover the further increases in wages, Mr. Hatton says, "However, owing to the wages being governed by a scale decided upon between the representatives of the tramway industry and the workers, adequate reductions could not be brought about at the time." At that time, he goes on to point out, the Newcastle Corporation decided to leave the National Council, and he gives the impression that the National Council, in its dealings with the operatives, had been so generous that Newcastle could not afford to adopt the National Council's decisions. Now, if my memory serves me right—and I think it does—I believe that Newcastle was not dissatisfied with the National Council's decisions on the ground that they had been too generous.

Mr. Hatton: They had been "had."

Alderman Higham: Newcastle did not follow the National Council's decisions in the opposite direction. We had decided—and practically the whole of the country had followed our decision, with the exception of Newcastle, and, perhaps, another place—that there should be a 48 hours week, but Newcastle said "No, that is not good enough for the workers; we will give our workers a 44 hours week," and they did so. Therefore to write that, "owing to the wages being governed by a scale decided upon by the representatives of the tramways industry and the workers, adequate reductions could not be made," is not quite right. But Newcastle had to come back to the National Council's decision, and in spite of the fact that the National Council was so generous, and in spite of the fact that the National Council was so incompetent, I suppose, to do its work, Newcastle abandoned the 44 hours week and adopted the National Council's decision. I have not heard that Newcastle is doing anything else now than following the National Council's decision; and therefore I disagree very much indeed with the suggestion put forward that it was because of the National Council's generosity that the difficulties in Newcastle had been accentuated.

Councillor W. G. Turner (chairman, Belfast Tramways Committee): I would like to take the opportunity of congratulating Mr. Hatton upon his excellent paper. Up to the present it has come in for some very severe criticism, but he is quite right in his last paragraph, as Mr. Baker said, that his views might not be acceptable to the majority. The last line, however, namely, that "the material given will produce a discussion of some value to the industry"—I think Mr. Hatton is right in that. Mr. Baker said he thought that not half a dozen people in the room would agree with Mr. Hatton. If I might be permitted, I would say that I am one of the half-dozen—but, however, I do not agree with Mr. Baker. I believe that the majority may be in favour of Mr. Hatton's paper. Mr. Murray said he did not agree either with the author of the paper or with Mr. Baker, but I want to say that I agree with a great deal of what both these gentlemen said. (Laughter.) Mr. Baker states, very properly, that the passengers should pay for their ride. (Hear, hear.) Mr. Hatton does not say they should not pay for their ride. Therefore is it wrong to agree with both these gentlemen on this matter? I say I agree with both of them in this. Whilst Mr. Murray was criticising the Newcastle system, and saying that he did not agree with either of the previous speakers, I was looking at the annual report, and if you will turn to page 54 you will see that the Newcastle system last year took £560,000 in revenue, although they are giving this penny ride of 1¼ miles, and they only had a deficit of something like £2,600. I turned over the page saying to myself "What about this man Murray?" (Loud laughter.) All the previous speakers have been long associated with tramway matters, and it is only right to judge people, not by what they say, but by what they do. "Though good words are good, good deeds are better; a man of words and not of deeds is like a garden of weeds." (Renewed laughter.) I am very sorry to refer in this manner to Mr. Murray, but here are the facts. The Walthamstow revenue was £104,000, and it is said that it is approximate. You do not get that in the Newcastle returns; you get the actual figures. (Laughter.) The actual revenue for Walthamstow was £104,000, and the deficit ran into £32,000. Then, with regard to working costs per car-mile, I find that Newcastle, with all their liberality so much talked about, ran their cars at 1s. 7½d. per car-mile, whereas the Walthamstow system costs 2s. 1½d. I agree with Councillor Higham that each system is a law unto itself as regards its fare and stages. It is the duty of the tramway committees of the public authorities that administer tramway undertakings to give the public the best possible value for their money, and I am further delighted to know that Alderman Mayne and his able manager can give the people of Newcastle a ride of 2,000 yards for one penny. I think that is very creditable. I have just been speaking to my vice-chairman and Mr. Moffet, general manager, to see if something cannot be done on these lines in our own city. I think it can. It is a matter of opinion what effect a reduction of fares would have on the revenue of any undertaking. You may reduce from 1½d. to a penny, and you may have almost as much money by the increased number of passengers carried. I am informed that in the city of Belfast there are thousands of people who will not travel on the cars because the minimum fare is 1½d.; they prefer to walk. Mr. Hatton is quite right when he says that with a penny fare a man can go to work in the morning, come home to lunch, go back to his work, and return at night for 4d. a day, whereas with a 1½d. fare it costs him 6d. a day, which means a difference of 1s. a week, and that is a factor of some importance, especially to factory girls and others receiving small wages.

Alderman F. Smith (deputy chairman, Liverpool Tramways Committee): I think we are greatly indebted to Mr. Hatton for his paper, because it deals with a question that is at the bottom, top, end and sides of tramway management. It is a cash job, and if you cannot make it pay you do not deserve to have the job at all. (Laughter.) Mr. Baker, whom we are always glad to hear, gave utterance to those platitudes we hear so often on the labour platform. He says that some people look for the reduction of fares to pre-war level, and he says "I hope not" if it means the reduction of wages. But who wants to press the working man down? None of us who have any brains. But what did he say about reduction of wages? Will the workmen give the production that they reasonably can give without undue pressure? Mr. Baker did not tell us the large amount which the tramway operatives take in wages, and the heavier cost of capital required for tramways. I do not care about the subject which Alderman Higham mentioned, of a dispute between the Newcastle Council and the Industrial Council. He knows very well that Mr. Hatton is not the sole manager. He knows very well that he is in the hands of his committee, and he knows very well how every committee feel when they cast their mental squint on to what will happen next November. (Loud laughter.) It is all very well to belittle Mr. Hatton, but if you will give me Mr. Hatton or any one of you gentlemen except Mr. Murray—(laughter)—I would run the Liverpool Tramways and get more money than we do. Liverpool gives all sorts of concessions to the working man. There are doles, insurance, and in the tramway service at Liverpool shorter hours. I think we give some 16 hours for four hours' work on many Sundays because of their rules and regulations. I do not mind paying a man a fair price for a fair day's work, and there is no man I have greater respect for than the loyal servant, the man with the brain, who really knows all about it and sticks to his job. But do you get that sort of service now? I venture to think that proper spirit is only slowly coming back to the service. In suggesting that the tramways should come on to the rates Mr. Murray is going far beyond the penny fare and far beyond the duties of a municipality. I never could understand why we should carry other than children in arms free, although there may be something to be said for half fares for children, but it wants very grave consideration. It is not right to burden the ratepayers or to diminish their legitimate profits by special regulations regarding a particular class. In Liverpool we are carrying the blind free as well as ex-service and wounded men.

The President, who had previously been asked, on a point of order, whether speakers were actually discussing the subject of the paper, said—Excuse me, but the subject before us is the practicability of a penny fare, whether it is a good commercial proposition, and if you could keep to that it would be the best thing.

Alderman Smith: The practicability of a penny fare depends very much on the other facilities you give. However, as you think I am exceeding the point to which I should go, I will say no more except that if the other speakers had stuck to the paper I should have done so also. (Laughter.)

Mr. A. Baker (Birmingham): Mr. Alderman Smith talked about penny fares. As a matter of information for this assembly would he kindly tell us whether his fare is not a 2d. minimum, and that he has no penny fares?

Alderman Smith: No, we have no penny fares. We have more sense. (Renewed laughter.)

Councillor B. Clarkin (chairman, Walthamstow Tramways Committee): Everybody will agree that the popular price for a tram ride is a penny. Walthamstow, with its big deficit which has been referred to by the representative from Belfast, has a penny fare and it is the policy of the people in power, which I am pleased to say is a Labour majority, to revert to the penny fare. Mr. Murray has referred to three schools of thought in this matter. Mr. Murray at one time had a Conservative party over him; to-day he has a Labour party. Mr. Murray is the manager at Walthamstow, and the committee manages Mr. Murray instead of Mr. Murray managing the committee. I should wish you gentlemen here to know that, and that it is the committee's blame and not the manager's. When my colleague from Belfast refers to that deficit, I say bluntly that

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the committee are fully responsible for it. It is our policy. The point has already been made that what applies in Newcastle will not apply in Belfast; but I think it would be the best policy for the Metropolitan tramways generally if they could adopt the municipal idea and give free rides. (A voice: "Rot!") My provincial colleagues who have no knowledge of London say "rot." (Hear, hear.)

The President: May I call your attention to the paper we are discussing—the practicability of the penny fare?

Mr. Clarkin: I was keeping to the point, but when people say "rot" surely I have the right to say whether I think it proper or not. I say they have no knowledge of London. The party which I represent consider that in the present system of administration of tramways the penny fare is the only and popular fare for the working people. Mr. Hatton is quite right when he says that the tramcar is the working man's motor car. I think that generally the working class use the tramcars to a much larger extent than any other class. I go so far as to say that 90 per cent. of the passengers on the tramcars are the working class, and they would therefore benefit by free tramways.

Councillor T. Woffenden (deputy chairman, Huddersfield Tramways Committee): As one of those who have to face that mental squint which Alderman Smith has referred to—(laughter)—in the coming November, I take it that we are all indebted and grateful to the reader of the paper for having introduced a subject like this; for we are certainly up against the demand for getting back again to the pre-war penny fare, and I think it is most essential, in a gathering like this, that this fact should be faced. We should get to know from each other what our local conditions are, and how far it is favourable for us to get back again to this pre-war position. Let me say at the outset that I believe that mention of the word "if" in front of the word "demonstrated" in the title of the paper—a big "if"—would be very useful, because it seems to me if we are to get back to the penny fare that depends upon many things being done of which there does not appear much prospect. You can get a penny fare, if I read this paper right, if certain conditions prevail, and the question to me is as to how we are to get these conditions. I agree with Mr. Baker that you can on no account cut the worker down to the very lowest level in order to get the penny fare. I agree that the worker has a claim to a fairer share than he had in 1914. (Voices: "We all agree with that.") I think we do; at any rate, do not let us go back again in that direction, because to do so only means creating seething discontent that will cause us a great deal more trouble than other means might do. We have had a great many speeches this morning that do not seem to help us very much—(hear, hear)—free education, free tram rides, etc.—but the principles of free education and free tram rides do not square with one another at all. We can discuss decentralisation as a means of helping the worker and as a means of increasing our revenue, but decentralisation will never help you. So long as you have houses right in the centre of your towns, so long will your people cling to these houses, and the very people you want to decentralise will not be decentralised, and the very people to whom you give cheap tram rides, will have to be subsidised, paid to some extent by the very people who are clinging to the houses in the towns. Therefore the only way is for us, as municipal authorities, to see how these questions affect us. I agree with what has been said that we must make our tramway undertakings pay, but the tramway undertakings in Liverpool, Birmingham, and similar places are in a much better position than we in Huddersfield, for instance, to run a penny service. We are running a 1½d. service, and we are paying our way, and until such times as we can see there is a possibility of knocking off the ½d. and making ends meet with the penny, we shall not feel justified in doing otherwise, because we should have to go to the ratepayers and ask them to make up the difference. It does not seem to me that there is any hope whatever of a universal penny fare. We shall have to deal with the matter individually as it affects each district, and apply what we think is the right principle, despite the fact that we have to face the mental squint of the November election.

Alderman R. F. Fletcher (chairman, Wigan Tramways Committee): There is no getting away from the fact that there is a demand for a revision of fares downward, and as a reduction in the men's wages takes place the demand will be greater. The attention of members of Tramways Committees will have to be focussed upon this most important question from the point of view of when the demand reaches a head, how will they meet it, and what will the result be? In order, if possible, to contribute to the discussion, and for the purpose of giving a lead to others to give all the information they can, allow me to say that our tramways department, which did so badly last year and the year before—indeed, it almost became notorious—is hoping to hold up its head with the best at the end of this year as the result of careful watching of the whole of the working, and especially the financial side. But there has been a demand for a reduced fare, and the best thing to do is to find out whether we can stand it. We have a medium size tramway undertaking in a town with a population of some 98,000; there are some 32 miles of track carrying some 300,000 passengers a year. A reduction of ½d. on the 1½d fare meant that to receive the same revenue would necessitate an additional 80,000 passengers per week. That is almost equal to the whole population of the town and meant that every inhabitant in Wigan, or their equal, would have to ride on the trams every week in addition to the number of passengers already being carried. That is the basis we shall have to go upon in deciding whether we can go back to the penny fare in the present conditions. (Hear, hear.) Then the general trade conditions must be taken into account. We are a mining community, and the colliers have been hit badly. We have, like yourselves, an obligation to run a workman's service, but if the majority of the pits are closed three days per week, that does not allow you to withdraw your workmen's cars. Therefore you are carrying a very greatly reduced number of workmen, because it is not likely they are going to leave their beds to ride on cars when they do not need to go to work. Accordingly, your revenue suffers very badly three days per week, but your expenses are not very greatly reduced because in every district there may be one or two collieries that are working every day, although the majority may be closed. All these things have to be taken into consideration. In my opinion it is justifiable for us to retain the 1½d. fare, even in spite of the greatly reduced earning capacity of the workers, because I am in agreement with Mr. Baker that you cannot possibly go back to the 1914 labour conditions with your men, and we ought not to go back to them. There was a time when the semi-skilled workmen, the tramway men, were the worst paid in the country, and we do not want that again. (A voice: "When was that?") We ought to be able to handle the labour problem better than any other industry, whatever some people may say about shirking. I am certainly not in agreement with Alderman Smith, of Liverpool, because in the tramway industry we have every act and every minute of the men's time recorded on the traffic side, and the manager knows exactly whether he is getting 20s. value for his £1 paid in wages. If the working man, working three days a week, and bringing home 23s. or 24s., cannot pay 1½d., you can take it for granted that that man, with a small family, cannot afford a penny and he will walk, and we cannot blame him for walking; but we cannot make a present to the public, because times are bad, of £20,000. If you do so you would have to take it out of the rates, and if you are running into out-districts then your own ratepayers are making up what the ratepayers of the out-districts are not paying. So there is only one policy for a medium-sized town, and that is to calculate exactly how many more passengers will have to be carried to make up the amount of money that it is proposed to present to the public. Let me give you the other side, the hopeful side, and it is this. Granted that general trade conditions improve, and the pits go on another two days per week, then it would be for our general manager, who is quite competent to deal with it, to find out whether the time had arrived when the penny fare might be locally adopted. It all depends on local conditions and general trade.

The President: It seems to me that a point has been missed which should not be missed in this discussion. I agree that very much depends upon local conditions, and nearly all the arguments seem to have been based on the fact that a 1½d. fare is charged now for what was once a penny fare. Is it possible to take that halfpenny off? I have felt, right from the beginning of the trouble, that there is something about the nimble penny that must not be interfered with, and that a man must be able to buy something with a penny, and my view is that if you cannot carry him a long way you should carry him a short way for a penny. If you do that I think you will find that many pennies will be spent which are not now spent.

Mr. J. Barnard (general manager, Bolton Corporation Tramways): I think there are many in this room who would be glad to get back to the penny fare, because we all used to argue in pre-war days that the penny fare is the backbone of any system; but I am of the same opinion as previous speakers, that you must have regard to local conditions in fixing fares. Perhaps I can speak with as good authority as anyone in this room, because in the town I represent, for seven or eight hours in the day we give 2,500 yards for a penny; that means that up to nine o'clock in the morning, from 12 to 2 in the afternoon, and from 4.30 to 6.30 in the evening you can travel at pre-war fares, and if you will turn to the balance sheet that is at the end of the report I think you will see that we have nothing to be ashamed of in the financial result that we obtained from the past year. I want to ask Mr. Hatton seriously—the figures I am going to use are the figures I have got out of the annual report that has been sumitted by Mr. Beckett—is he justified in giving 2,000 yards for a penny? If you will look at the end of the report, you will find that the Newcastle Tramways took in traffic receipts £500,000,

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and the financial result, without providing for depreciation or renewals, was a deficit of £2,667. I suppose most of you read the evidence of Mr. McElroy and the others who conducted the case on our behalf before the Court of Inquiry, and I think one of their biggest arguments was, first, that the tramways should be self-supporting, and, secondly, that an adequate sum should be set aside each year for depreciation and renewals, and that sum was agreed upon, I think by both sides, as 2½d. per mile. Now I think, upon working it out, that if Newcastle had carried out the arguments of our side in the Court of Inquiry, instead of having a deficit of £2,667, they would have had a deficit of £63,000. Now is it just and right to come and place the argument before the smaller towns, which have not got the population, and cannot possibly get the receipts that they get in Newcastle, that the penny fare is the correct policy for 2,000 yards, when they get a loss of over £60,000 in a year? I should like to make a correction to what Alderman Fletcher just said, namely, that in pre-war days the tramway man was the worst paid unskilled or semi-skilled man in any industry that ke knew of. All I can say is that if he will go back and search his records, he will find it was not so in the county that he comes from.

Bailie James Smith (convener, Ayr Tramways Committee): I should like to pay a Scotch compliment to Mr. Hatton for his courage in introducing this subject. I should like to say that I agree with the suggestion that we must try to find a way back to penny fares at the earliest possible moment. The penny fare is being demanded by all classes of the community, as well as by the poorer working classes, and Alderman Mayne puts it in the proper sense when he says that we want something which a penny will buy, and I think a penny fare ought to be provided. If H.M. the King were at any time to send for Mr. Hatton and make him Chancellor of the Exchequer, I trust he will be kind to the tramway industry, and relieve it of a great many of the burdens which are unjustly placed upon it now. (Laughter.)

Mr. James Dalrymple, C.B.E. (general manager, Glasgow Corporation Tramways): I take it that the majority of us are agreed that a tramway should pay its way. (Hear, hear.) I would start on that assumption. We have more experience now with regard to the question of tramway fares than we have ever had before. We had the experience up to about 1920 of the lowest fare that we had reached at that date, and know what the result was in the number of passengers carried and the revenue earned. Then we entered an era of higher fares, and we have the experience of the working of the higher fare. Generally, I think that experience has been that the number of passengers carried was much lower than before, but the revenue earned was considerably higher than before. Now the question that is being pressed upon us, all over the country I suppose, is this—has the time come for again reverting to the pre-war fare, or at least reducing the present fare, because I take it that Mr. Hatton's question is not simply "Can we have a penny fare?" It really means, "Can we reduce our fares all round?" We know what the result of the lowest fare that we had reached was; we know how many passengers we should carry if we went back to that fare, assuming that trade was very much as it was before. We know, also, exactly what revenue that fare will yield, and to my mind the question is a very simple one. We know what it will yield, and what our expenditure is; therefore what steps have we to take when we know these two points? Most of us know that a reduction in fares at the present moment will not yield the revenue that is necessary to meet our present expenditure. (Hear, hear.) We know that, and, knowing that, what is the use at the present moment of considering the question of a reduction of fares? We ought to be satisfied in our own minds that, if we can carry the maximum number of passengers that we have ever carried, if, in carrying that maximum number of passengers, we know the exact revenue that we shall get, we have to determine if that revenue will meet our present expenditure. It it will not, then I think the time has not yet arrived when we can decide upon any reduction in fares.

Alderman T. S. James (chairman, Northampton Tramways Committee): Representing an undertaking which paid 20s. in the £1 last year, I should like to ask Mr. Hatton a very pertinent question, and on the answer to it depends a great deal whether we should eulogise Newcastle or not. My question is, how much did Newcastle take out of its reserve funds last year to pay for track renewals, and what is the position of the reserve fund at the present time?

Councillor J. H. Whittaker (chairman, Todmorden Omnibus Committee): We have only come amongst you recently, and we are a very small undertaking, but the question of a low fare is a very important point even with us. I wish to ask the reader of the paper a question in regard to one paragraph, because I notice that when he read this particular paragraph there was some applause from the audience. He referred to the high wages being paid in the industry, and also to the fact that the Newcastle authority had decided to withdraw from the Industrial Council. Putting two and two together, I have come to a conclusion, but I want to ask him whether I am right or not, namely, that the Newcastle authority withdrew from the Industrial Council because they were not satisfied with the wages reductions agreed upon by the Industrial Council?

The President: They withdrew two years ago, and for that reason.

Councillor Whittaker: I agree with the first speaker this morning that it is impossible to reduce fares to the 1914 level and continue to pay wages such as we shall be compelled by common humanity to pay for a considerable period yet. We cannot hope to get wages down anywhere near the 1914 level, and if we are to run our public services successfully, then obviously it is our duty to make them pay their way. As a Labour member of my Town Council, and chairman of the Motor Omnibus Committee, it is difficult for me to stand in the way of a reduction in fares, but when I come to see that the only alternative will be to face a deficit, and place the burden on the rates, then I say, as a democrat and as a working man, I am in favour of giving to the public the full benefit of the fares which they pay. I do not desire to make any profit, and if you are returning to the consumer the whole of the cost of producing the service which he is paying for in his fare, then I say that we are doing justice to the consumer, and it is the only sound basis on which we can continue to work. I looked into one small matter in connection with our own undertaking, and found that if we were to reduce our fares by one-sixth, it would turn a profit into a loss, and we could not afford to place the burden on the rates.

The conference then adjourned, and the discussion was resumed after luncheon.

Mr. G. W. Holford (general manager, Salford Corporation Tramways): I do think it desirable to endeavour to show that several of the speakers this morning did not get what I would call the correct view point of Mr. Hatton's paper. I do not think Mr. Hatton intended, or suggested for a moment, that we should resume pre-war rates of charges for travelling. What he has endeavoured to establish is that there is a case for a penny fare, or a penny stage; what the length of that stage is must be a matter for local decision, whether it is 2,000 yards, or a mile, or anything more or anything less. We are much interested in this particular point in our own borough, because a few months ago pressure was brought to bear to reduce our fares or lengthen our stages, as our sister city was doing it; and whatever our sister city does, it is always suggested that we should also be able to do. However, we could not go quite as far as they did, but we did go a certain distance, and we practically brought the penny stage up to the length that Mr. Hatton now gives, i.e., 2,000 yards, but this has had a peculiar result. Prior to the alteration of stages, our income had gone down 5 per cent. Our reduction, or our increased stage, was equivalent to a 10 per cent. reduction, and, strange to say, our financial result has been that there is a decrease of 15 per cent., which shows that the reduction exactly corresponds with the decrease; and, with regard to passengers carried, there were practically no more. Thus there is a certain point in Alderman Fletcher's argument that there is no guarantee that you will increase your passengers by reducing your fares or lengthening your stages. (Hear, hear.) I think the argument is as to whether we can give a penny stage, and what length that stage should be; and Mr. Hatton has endeavoured to prove that under reasonable conditions he can give a 2,000 yards stage for a penny. In other cases it might be 2,200 yards, or 2,400 yards, or it might be less. I was pleased to hear Alderman Fletcher so boldly say that he would resist any reduction in his 1½d. minimum fare until conditions justify it, because a few years ago at the Glasgow Conference I submitted a paper along with Mr. Barnard and Mr. Priestly on tramway finances, and Mr. Fletcher was a very strong opponent of ours at that time, and he argued very firmly that there should be no charge at all on the tramways. He has improved since then—(loud laughter)—and now he favours the 1½d. minimum until he can afford to go lower. I am very pleased, and, as I told him at Blackpool, when all other necessities of life are given free then is the time we might consider free rides on tramcars.

Mr. A. L. C. Fell (general manager, London County Council Tramways): I feel in a somewhat delicate position, because I am one of those alluded to by Mr. Baker this morning as having dared to put a penny fare in operation in London. Mr. Dalrymple, this morning, said that he knew exactly what his revenue was, and he knew the number of passengers, and knew exactly where he was. The difficulty in London is that we do not know where we are, because we have enormous competition. Mr. Dalrymple possibly has not felt what the effect is when you have 700 or 800 omnibuses running against you on the streets, and that is the position in London. We wanted, like other authorities, to get increased fares, and we put them into operation, and it was successful as long as trade was

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good and the economic conditions were good. When trade began to get bad people could not afford to pay the increased fares. We had a penny fare throughout, and when the fares were increased the penny fare was only for a distance of 0·6 of a mile, but we found from observations that vast numbers of people, rather than pay a penny for 0·6 of a mile were walking, and they certainly would not pay 1½d. for a little over a mile. Therefore, last October or November we practically abolished the 1½d. fare and simply charged a penny for what we had previously been charging 1½d., namely, 1·2 miles. I have recently taken out the figures for July and August last year, when the increased fares were put into operation, and for July and August of this year, and I find that if you take the ordinary penny fares and 1½d. fares alone we are taking more money to-day than we took last year, and we are carrying a vastly increased number of passengers at these fares. (Hear, hear.) The only nigger in the situation is that the workmen have fallen off enormously, and we are getting less now from the workmen than we did previously, so that on the whole there is a slight decrease in revenue from these lower fares. Where we got a very large decrease is on the fares above 2d., the long distance passengers, and it is purely and simply that the people have no work, and they do not travel, and therefore they do not pay. We have tried to meet the situation by decreasing the fares. I agree with Mr. Dalrymple, of course, that you should charge such a fare that the tramway will pay, but we have had to experiment to see how we can best make the tramways pay. It is not a question of charging a penny for a pre-war stage at all. We are charging a penny now for 1·2 miles, whereas we gave 2 miles for one penny in pre-war days, and I do not think for an instant that we shall ever get back to the pre-war stage of 2 miles for a penny. At the same time I do think that, whatever happens, the penny is going to be the tramway fare for a good many years to come. It may be that you will have to adjust the distance, but I am certain that the penny is the coin that is going to be the useful coin as far as tramway passengers are concerned. There is a very strong objection on the part of passengers to having to produce two coins, and always having to get change. It is like the nuisance of having to pay 1½d. for a daily paper, and as soon as people get back to a penny paper, the better it will be for the papers concerned. We have not been running a full year yet on present fares, and I cannot give detailed figures, but even then we shall have great difficulty in really taking these figures as a basis for fixing fares for the future, because the conditions are so extraordinary at the present time, owing to bad trade and other things. Tramways should be treated like ordinary businesses. (Hear, hear.) An ordinary business has to go up or go down; it cannot stand still, and I know of heaps of business undertakings to-day who deliberately say "We are going to have a loss for so many years in order that we may get a permanent gain," and I think that is the policy tramway undertakings should adopt to-day. It may be necessary to run at a slight loss for a time, in order that you may establish your traffic and get it fixed, and I am sure it would benefit the undertaking in the end. I feel, of course, that we are in a very critical position. With regard to traffic, you will notice that every class of traffic is falling at the present time, and that all depends on trade, but as soon as trade improves I am sure tramways will feel the full benefit of it. Even now we ought not to stand still, and we must make further adjustments with regard to our fares. It is not right simply to stand still and make no adjustment whatsoever. I feel that conditions which may apply in London probably do not apply to the majority of undertakings in the country, but I think that every undertaking in the country must settle this matter for themselves, and, as far as London is concerned, we are doing our best to settle it.

Mr. J. S. D. Moffet (general manager, Belfast Corporation Tramways): As general manager of the only Irish system represented in the Association to-day, I would like a word or two. Mr. Hatton deserves our thanks for giving us a paper on a subject which I think I can safely say is engaging the attention of every tramway committee in the country, and is undoubtedly exciting a great deal of public interest throughout the length and breadth of the land. In fact, as one speaker said earlier in the discussion, the public is demanding reduced fares, but what is demanded and what can be given are two entirely different propositions. The title of the paper, "An Argument for the Penny Fare Demonstrated by Actual Experience," should, I think, have borne the words "Demonstrated by Actual Experience in Newcastle," and then Mr. Hatton would have been on safe ground. I think everyone will agree that it is a subject that cannot be dogmatised or generalised upon. Each undertaking must take into consideration its own conditions As Mr. Fell said a moment ago, London conditions will not compare with the conditions in the provinces, and I can say that Belfast conditions will not compare with conditions anywhere else. (Loud laughter.) Not only have we a slump in trade, but we have also had internecine warfare. We in Belfast stuck to the penny fare as long as we could, but in 1921 we were compelled to adopt the 1½d. minimum. It was not a bit of good keeping it up any longer, for we should have lost tens of thousands. The reason why we adopted it was that 60 per cent. of the travelling public live within 1½ miles of the city centre, and had not contributed a cent towards the extra costs of transport. Until 1921 the passengers increased, and the slump had actually set in, with penny fares, before we adopted the higher minimum. The slump had set in in February, and the 1½d. fare was adopted in March, and the slump was not aggravated to any extent by this higher fare; that is the remarkable thing. You would have thought that with bad trade people would have stopped riding altogether when the higher fare was put into operation, but instead of that the slope of the curve of passengers carried actually flattened out a bit, whereas you would have expected it to go deeper.

The President: You mean the passengers, and not the receipts.

Mr. Moffet: Yes. Naturally you would expect the passengers to fall off rapidly, and when we put on the 1½d. fare I had my heart in my mouth because I thought it was going to aggravate the slump, but it did not. Belfast originally, in 1905, had a semi-universal fare of one penny which covered about five miles, and after that we introduced a 2d. fare which covered nine miles, so that we were carrying much further distances than Mr. Hatton in those days, and the remarkable thing is that during the period of ten years the increase of traffic with low fares was very small. In fact, low fares were brought into force, as in every other system, to encourage living at a distance from the centre, but did they? The answer is "Very slightly." Certainly there was an increase, but it was a very slight increase, through people going into the country districts to live. The greatest growth in passengers carried actually occurred after increasing the fares in 1917, when we raised our fares by reducing the stages. We kept the 1d., 1½d., and 2d. fares going, but we reduced the stages, and the greatest growth in passengers actually took place after that. Further, it does not necessarily follow that there will be an increase of passengers if the fares are reduced, as it all depends on the conditions prevailing in the district. We have had an admirable illustration of that this morning by the chairman of the Wigan Tramways Committee. The question therefore boils itself down to this simple issue. If the policy has been laid down by the Council that the tramways undertaking is to be run as a commercial proposition, the penny fare, in my opinion, can only be introduced if it will make ends meet, after every allowance has been made for fair wear and tear, depreciation, and the renewal of the system on the latest and most efficient lines as and when it requires it. After all, it is an economic proposition, and the laws of economics are bound to prevail when all is said and done.

Mr. W. Chamberlain (general manager, Oldham Corporation Tramways): I agree that different conditions in different towns must determine this question. In large towns you can distribute the population, but in moderately sized industrial towns, such as Oldham, the position is quite different. The Oldham Tramways Committee was anxious to reduce to a penny fare, but we had enough to guide us in dealing with the proposition, inasmuch as we had gone up ½d. from 1d., and we knew that we could not possibly go back to the old penny ride. Therefore we put into force an average ride of 1,000 yards for one penny. That has been in operation for two months, and has been a very great success. The point I want to make is that although we cannot possibly go back to the pre-war stage for the penny, we can do something, and that is, that instead of having a 1½d. minimum, we can carry passengers short distances at a penny fare, and we are doing it with great success at Oldham.

Mr. H. P. Stokes (general manager, Plymouth Corporation Tramways): I am a representative of an undertaking which is perhaps unique in that we are giving for a penny a greater distance than was given in pre-war days. On the last page of the paper the author states that the distance given for a penny should not be less than that laid down by the early Tramways Acts. Our penny stage is not less than that because we are giving approximately 1½ miles for a penny. We had to adopt the 1½d. minimum for a period of twelve months in order to recover from a serious slump which we had, but we converted our position from a deficit of over £12,000 to a surplus of about £10,000. It seems to me, as has been said, that the nimble penny always has been and always will be the real basis of our revenue. When the 1½d. fare was in force in Plymouth I found that it caused a tremendous amount of annoyance to the travelling public, due to the fact that they had to get two coins. There was always a lot of bother about getting enough half-pennies, and since we have gone back to the penny fare our passengers have increased considerably, and also our revenue, although this summer has not been by any means a good one so far as the weather is concerned. Nevertheless, our revenue shows a slight increase in spite of the exceptional weather conditions this summer. In fixing a penny fare it seems to me that you can apply a principle to every

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undertaking, wherever it may be, and the principle which I have endeavoured to arrive at is that you have certain definite standing charges which have to be met; you have a certain minimum mileage which you know will be necessary to meet the requirements of the people you are serving, and that enables you to arrive at some basis which will define the economic distance to which you can carry your passengers. It may be that in some small towns the distance would be so short as to be impracticable, and they may not have arrived at the point where they can give a reasonable distance for a penny. But that is a basis for fixing tramway fares, and having secured your passengers on a basis to cover the standing charges which you have got to meet, whether trade be bad or otherwise, then you can extend your long distance fares out and give the utmost advantage to your passengers once having had the trouble of picking them up and overcoming your standard charges. I feel myself that the sooner we aim at getting back to the penny fare the quicker will be the revival of the tramway industry.

Mr. Hatton, replying to the discussion, said: I cannot see the point of Mr. Baker being so annoyed in referring to pre-war fares. I should think he would return to Birmingham a much happier man after this conference if he had discovered that he could reduce his fares.

Mr. Baker: I was not annoyed. (Laughter.)

Mr. Hatton: I have not said anything in the paper about reverting to pre-war fares. We cannot do it, not for a very long time. I told you in the paper what we did in this town to improve our revenue. All our 1½d., 2d., and 2½d. fares remain as they were before the war; the only alteration that was made was that the 1d. distance

Mr. Ernest Hatton,
General Manager and Engineer Newcastle Transport and Electricity Committee.

was shortened, and that is my contention, that one should be able to buy something for a penny. (Hear, hear.) The price of bread may vary in different towns, but surely you should be able to buy some bread for a shilling in any town. You cannot buy the same quantity in every town, but you should be able to buy some. Some speakers have told us their experience of going back to the penny fare—that their traffic has still gone down. Now, on certain omnibus routes that we have here, running out into the mining areas, the miners told us they could not afford to pay the fares, and that they would rather walk one way and ride the other. Now that we have dropped these fares the traffic has increased considerably; but revenue has not increased much, although the number of passengers in one case has doubled. Having got these passengers, directly our expenses go down we are going to make a good thing out of them, because these passengers will not desert us. Mr. Barnard has raised the question of our loss this year, and said that if we followed the McElroy-Beckett depreciation dictum, which was frightened out of them by Bevin—(loud laughter)—we should have made a loss of £60,000. But we do not admit for a moment the McElroy-Beckett 2½d. a mile depreciation. We have our own standards. Another gentleman wanted some information about our loss and about our reserve fund. Well, last year we had a three weeks' holiday, during which there was no revenue at all, and if we had 52 weeks of that we should have had no revenue throughout the year. It cost us £13,000, and while the colliery strike was on we had to switch over to oil fuel, another expensive item for us as the plant was very costly. These two items alone cost us £20,000, and as a matter of fact we finished up with a deficit of under £3,000. This year or even next year we should have a considerable margin on the right side. Further than that, we bought £40,000 worth of omnibuses out of our revenue over different years. We do not borrow money for that sort of thing. The whole of our power-station plant and our four sub-stations was paid for out of revenue. We do not regard ourselves as bankrupt, even if you people who come here think we are. (Loud laughter and cheers.) Not by any means. We have got a magnificent undertaking, and we are going to reduce our expenses and try to retain the whole of our traffic and give the people what they are entitled to. We would much rather follow the shipbuilders in this area. They could not get any orders for ships, and they have had to cut their wages tremendously. They still cannot get orders for ships, and the wages will have to come lower. You are handling a monopoly, and if they were handling a monopoly they would soon build the ships and make profits. That is what you must think about. Then Mr. Baker talked about the standard of living. We do not want to cut it down; I would like to go back to what I had in 1914, but I cannot get the same standard of living. I pay a lot more for it, but I do not get it, and there is another thing which seems to me absurd in a town like Liverpool. They are doling out money, say £1 or £2 a week, and taking it back again from the people in 2d. tram fares. Why not given them £1 and charge them 1d. (Loud laughter.) It would be in the same proportion.

Alderman Smith (Liverpool): It is not the same people.

Mr. Hatton: You can say what you like about it, but the public have not the money to pay these dear fares, and they are looking to you to do something to bring the ride within the capacity of their purse, and it is up to you to do it. We are endeavouring to do it; it will be a very long time before we get back to what we used to do, but we are endeavouring to get there, and I think it is the proper thing. With regard to the reserve fund, it is only £1,000 now; it was £300,000, and we have spent it instead of borrowing money, and put in turbine plant and bought omnibuses and built new sub-stations. We do that out of revenue.

Mr. Barnard: What is the outstanding amount on the Newcastle tramways?

Mr. Hatton: Our total capital is £1,630,000, and we have repaid £815,000, leaving £816,000 outstanding.

Mr. Priestly (Liverpool): With regard to the distance carried on the Newcastle tramways for one penny, the author said in the paper that it should not be less than that laid down by the early Tramway Acts, which was one mile. His distance is less, and therefore his statement is not consistent with what he is doing.

Mr. Hatton: We are giving 1¼ miles.

Mr. C. Furness (general manager, Blackpool Corporation Tramways): We have had a bright and breezy discussion, and many of us will go away with much food for thought. We cannot all agree with all the speakers, but there is some modicum of truth in what has been said, and I have the greatest pleasure and confidence in moving a hearty vote of thanks to Mr. Hatton for his paper.

Mr. A. Baker (Birmingham): May I be allowed to second that motion. I purposely made my remarks as nasty as I could for the sole object of getting up a good discussion—(laughter)—and I feel sure that so far as the position I took up in the matter is concerned it has been amply justified. We have had an excellent discussion on a subject which is of vital importance not only to Newcastle, but to every undertaking in the country.

The President: I think you will agree that the discussion has not only been bright and breezy but also brotherly.

The resolution was carried with acclamation.

Mr. Hatton: I thank you very much indeed for the interest you have taken in the paper. It was not a voluntary effort on my part; it was due to the fact that the general secretary told me to write it. (Laughter and cheers.)

Mr. Beckett (general secretary): I want to make one remark lest negotiations proceeding elsewhere should be prejudiced. Mr. Hatton thought it prudent to blow upon the formula for depreciation, but he is now speaking in 1922, and the formula was arrived at in 1920. Mr. Hatton could not have blown upon the 2½d. per car-mile in 1920, and the figure itself was not an invention of McElroy and Beckett; it was devised by the Ministry of Transport, and it was quite a proper thing to import that figure into the finances of the industry at the time. We may have to take a smaller figure in future, but I do not want it to go out from this meeting this morning that you deprecate the importation of that figure as representing approximately the cost of renewals. The figure was devised by the Ministry of Transport, and at the time was true; it may be lower now.

The President: All is forgiven. (Loud laughter.)

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THE LEGAL ASPECT OF THE QUESTION OF ELECTROLYSIS.

By M. P. HEATH
(*Town Clerk, Manchester*).

The question of the legal liability of tramway undertakers for damage occasioned by the leakage of electric currents—electrolysis—used for working electric tramways has attracted attention consequent upon the decision of the Court of Appeal in the recent case of the Postmaster-General *v.* The Blackpool and Fleetwood Tramway Company, Limited (xxxvii. T.L.R.). In the circumstances of this case it was held by the Court of Appeal that the Postmaster-General was entitled to recover, under the provisions of the Blackpool and Fleetwood Tramroad Act, 1896, certain sums expended on the repairs to Post Office cables which had been injured by the leakage of electric currents from the tramway system. This case was decided upon the special provisions, in favour of the Postmaster General, contained in the Act of 1896, and whilst it may be regarded as an authority in cases of a similar kind, in which the Postmaster-General is concerned, it is not to be regarded as an authority in claims for damages for electrolysis from others, such as water and/or gas undertakers, unless, in the unlikely event, such undertakers have obtained similar statutory protection in the Orders or Acts of Parliament affecting the undertakings.

The question of nuisance and damage from escaping electric currents used in connection with a tramways undertaking first engaged the attention of the High Court in the year 1893 (National Telephone Company *v.* Baker: 1893, 2 Chancery). At that date the National Telephone Company instituted proceedings against one Baker, the lessee of an electrically operated tramway undertaking, alleging, which was the fact, that by reason of the escape of electric currents from the tramway system, disturbances were occasioned to the company's telephone wires. The tramways undertaking was authorised under a Provisional Order, and was worked by the best known system of electrical traction known at that time.

The Telephone Company's case was based on the law laid down by the Court of Exchequer in Fletcher *v.* Rylands (Law Rep. 1 Ex. 256), and recognised by the House of Lords (3 H.L. 330), i.e., that a person who for his own purposes brings on his land and collects and keeps there anything likely to do mischief if it escapes, must keet it at his peril, and if he does not do so is prima facie answerable for all the damage which is the natural consequence of its escape—whether the thing so brought be beasts or water or filth or stenches.

The defendant's answer to the plaintiff's claim was twofold. Firstly he pleaded that by an alteration of system the plaintiff could have prevented the disturbances complained of, and secondly that he was acting under statutory powers, and that if by the proper exercise of these powers the plaintiff was injured he was free from blame.

Kekewich J. ruled that although it was a novel argument to apply the principle of Fletcher *v.* Rylands to damage occasioned by escaping electric currents—the application of which doctrine to an electric current and the possible consequences of its discharge into the earth could not have been present to those who enunciated the law in Fletcher *v.* Rylands—he failed to see any reason why the principle should not be applied.

As regards the defendant's defence, Kekewich J. ruled on the first plea that the plaintiffs could not be obliged to change their system because thereby the defendant might possibly be enabled to conduct his business without the mischievous consequences then ensuing. With regard to the second plea—that defendant was acting in the proper exercise of statutory powers—Kekewich J. ruled that the act complained of was done in pursuance of a Provisional Order confirmed by Act of Parliament, and was protected to the same extent as other nuisances under statutory authority. Provisional Orders in connection with tramways undertakings being then common, must be treated as a well-known and recognised class of legislation equally as much as the "Railway Acts" referred to in the case of London, Brighton and South Coast Railway Company *v.* Truman, 6 App. Cas. 192, which in this case were assumed by the Lord Chancellor to establish the proposition that the railway might be made and used whether a nuisance were created or not. Kekewich J. held that the defendant being expressly authorised to use electrical power the Legislature must be taken to have contemplated it and to have condoned by anticipation any mischief arising from the reasonable use of such power.

It will be borne in mind that in 1893 the telephonic system carried on by the National Telephone Company was carried on under licence from the Postmaster-General. The National Telephone Company enjoyed no special statutory protection, and were, as regards claim for damage by electrolysis in no better or worse position than water or gas companies.

It is to be observed, in the case of the National Telephone Company *v.* Baker, that the Postmaster-General had obtained in the Order relating to the tramways operated by Baker special protection to the effect "it shall not be lawful for the promoters to lay down any line or rail or to do any act or work for working such tramways by electricity whereby any telegraphic line of the Postmaster-General is or may be injuriously affected," and it was argued by the defendant that the exception thus made in favour of the telegraphic lines of the Postmaster-General indicated that interference with other like lines was intended to be permitted.

Shortly after this decision a Joint Committee of the House of Lords and of the House of Commons was set up to consider and report whether the grant of statutory powers to use electricity ought to be qualified by any prohibition or restriction as to earth return circuits, or by any provisions as to leakage induction or similar matters, and, if so, in what cases and under what conditions, and with authority to settle any necessary clauses. The Committee reported in July 1893, that, amongst other matters, the Board of Trade should have power to make regulations to secure the best system of working electrical tramways and railways, and a clause was agreed. This clause was subsequently revised, and in its revised form has been inserted in every Act or Order made since 1893, authorising the electrical working of a tramway. The clause requires the undertakers to take all reasonable precautions in construction, &c., of electrical lines, and in the working of the undertaking, so as not injuriously to affect by fusion or electrolytic action any gas or water pipes or other metallic pipe, apparatus, structures, or substance, or to interfere with the working of any wire, line, or apparatus, from time to time used for the purpose of transmitting electrical power, or of telegraphic, telephonic, or electric signalling communication. The clause further provides that the electrical power shall be used only in accordance with the Board of Trade regulations, and the undertakers are deemed to take all reasonable and proper precautions, if and so long as they adopt and employ means of preventing injurious interference as may be prescribed by the Board of Trade regulations.

Many attempts were made by gas and water undertakers, when tramway powers were being sought, to obtain clauses rendering the tramway undertakers liable in any event for injurious interference to pipes, etc., from electrolysis. In several cases clauses were obtained, but after the subject had been fully debated in Parliament in the Beckenham and Torquay Bills (Session 1904), the uniform practice has been to disallow the insertion in Tramway Acts of special clauses dealing with damage by electrolysis. This view is based on the principle that under the clause settled by the Joint Committee of 1893 the Board of Trade are to make regulations dealing with the matter, and that if the existing regulations are not sufficient they should be amended, and that it has not been shown that such regulations are insufficient.

Clauses for the protection of the Postmaster-General were reduced to a common form in 1911, and such require the undertakers to construct their electric lines and works with due regard to the telegraphic lines used or intended to be used by the Postmaster-General, and to use every reasonable means to prevent injurious affection to the telegraphic lines or the currents therein. If any telegraphic line is injuriously affected by the construction or working of the undertaking the Postmaster-General is to be paid the expense of all such alterations in the telegraphic lines as may be necessary. Contravention or wilful non-compliance with the clause involves the undertakers in the payment of certain stated daily fines.

The case of the Postmaster-General *v.* Blackpool and Fleetwood Tramroad Company, previously referred to, is instructive as to the construction which has been placed upon language similar to that contained in the model clause. In this case the Company's tramroad had been constructed under the Blackpool and Fleetwood Tramroad Act 1896. The tramroad was worked by electricity, and the regulations of the Board of Trade had been observed and complied with.

In 1914 the Postmaster-General caused a lead cable to be laid containing telegraph wires which at certain points were within seven feet of the defendant company's electric lines. It was admitted that the lead piping or cables were telegraph lines within the meaning of the Telegraph Act 1878, and the Act of 1896.

In June 1916 the cable was found to be injuriously affected by electrolytic corrosion due to leakage of electric current from the defendant company's lines. The defendant company made an engineering suggestion to the Postmaster-General, who complied with the same, whereupon the corrosion either ceased or was diminished as far as possible.

The provisions for the protection of the Postmaster-General contained in the Act of 1896 are so far as the point under consideration is concerned similar to those of the model clauses

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settled in 1911. For the sake of greater clearness they are here stated—

65 (1) The company shall construct their electric lines and shall work their undertaking in all respects with due regard to the telegraphic lines from time to time used or intended to be used by Her Majesty's Postmaster-General, and the currents in such telegraphic lines, and shall use every reasonable means in the construction of their electric lines and other works of all descriptions and the working of their undertakings to prevent injurious affection whether by induction or otherwise.

(2) If any telegraphic line of the Postmaster-General is injuriously affected by the construction by the company of their electric lines and works, or by the working of the undertaking of the company, the company shall pay the expense of all such alterations in the telegraphic lines of the Postmaster-General as may be necessary to remedy such injurious affection.

(6) For the purposes of this section a telegraphic line of the Postmaster-General shall be deemed to be injuriously affected by an act or work if telegraphic communication by means of such line is, whether through induction or otherwise, in any manner affected by such act or work or by any use made of such work.

The cost of the alterations was the sum of £16 18s., and the case originally came before the County Court Judge, who held that Sub-section 2 of Section 65 must be read along with Sub-section 1, and that as the Postmaster-General had not proved that the defendant company had not constructed or worked their undertaking in all respects according to the best means within their powers, and with due regard to the telegraph cable, or that they had not used every precaution to prevent the cable from being injuriously affected, judgment must be given for the defendant company.

The Postmaster-General appealed to the Divisional Court. Before this Court it was admitted that the County Court Judge was wrong in holding that Sub-section 2 must be read along with Sub-section 1, and it was admitted that Sub-section 2 is entirely independent of Sub-section 1.

It was contended by the defendants that they were not liable under Sub-section 2 for the telegraphic lines of the plaintiff which were injuriously affected, not by the working of the defendants' undertaking, but by plaintiff's own negligent act. The County Court Judge, it was contended, found that the defendants had worked their undertaking with due regard to the telegraphic lines of the plaintiff, and had complied with the regulations of the Board of Trade, designed for the prevention of injurious affection. The Court held that the liability of the defendants under Sub-section 2, which is to be read independently of Sub-section 1, was an absolute liability, and that neither the fact that the defendant had used every reasonable means in the working of the undertaking to prevent injurious affection of the plaintiff's cable, nor that the plaintiff by laying his cable so near to the defendants' lines had courted the injury, afforded any defence.

The defendants appealed from this decision to the Court of Appeal. The appeal was dismissed.

The Master of the Rolls in his judgment stated "if it were to be shown that the cable was injuriously affected in the position in which it was by the construction or working of the tramway line, it would be no answer for the appellants to show that the Postmaster-General was guilty of unreasonable lack of care or skill in selecting the place for the laying of the cable. If, on the other hand, it could be shown that the construction and working of the tramway line did not injuriously affect the cable, but that it was so affected by the act of the Postmaster-General, then Sub-section 2 might not apply."

It will therefore appear that notwithstanding the Postmaster-General be negligent in selecting the place for his telegraphic of telephonic cable, if the same are injuriously affected by the construction or working of a tramway line, the Postmaster-General is entitled to require the tramway undertakers to pay the expense of all alterations in the telegraphic or telephonic lines as may be necessary to remedy such injurious affection.

It has been stated by a distinguished judge of the High Court that the reasons why the Postmaster-General has such exceptional powers is that the Postmaster-General has a prior right to lay telegraphic wires in a highway, and that tramway undertakers can only bring a tramway into the highway subject to that right. But inasmuch as it is now settled law that the negligent exercise by the Postmaster-General of his powers does not relieve tramway undertakers from paying the cost of alterations to the telegraphic wires of the Postmaster-General (and which alterations may be entirely attributable to the negligent conduct of the Postmaster-General's agents), it is submitted that an alteration of the law is necessary, and that the proved negligence of the agents of the Postmaster-General should disentitle him to recover the cost of alterations.

DISCUSSION.

Mr. A. L. C. Fell (general manager, London County Council Tramways): In considering this matter one has to realise that the Postmaster-General has most drastic powers, and one has to think of what the Government would say or the public would say if we did create disturbances to the Postmaster-General's cables. Therefore I think we might do in this case as we have done in many other instances with Government Departments. In the case of the Board of Trade and the Ministry of Transport, when they have issued regulations which we have considered arbitrary or unreasonable or regulations with respect to which we think we might in some way assist to put matters right, we have approached them and discussed details, and after discussion they have generally modified their regulations or done something to make the situation a little easier. What I was going to suggest to the conference was that if you would instruct the Executive Committee to appoint a technical committee to meet the experts of the Post Office, they might in the first place go into the subject; they might even see the Ministry of Transport or Board of Trade and get their views, and then ask the Postmaster-General if he would be prepared to allow his technical experts to go into the whole matter with our technical experts to see if we cannot come to some reasonable working arrangement. We are both public servants, and I think if we take that line—in fact I am sure—we should be met in the spirit of co-operation by the Postmaster-General's people. I therefore would like to move as a resolution—

"That this conference is of opinion that a small technical committee should be appointed by the Executive Committee to go into the whole question now under consideration, and that the Postmaster-General be asked to allow this committee to confer with the technical officers of the Post-Office in order to discuss the matter with a view to arriving at an amicable and satisfactory solution of the problem, and that the Executive Committee be instructed to make the necessary arrangements."

I think that would meet the case.

Councillor J. Gordon (Liverpool): I have much pleasure in seconding the resolution, which I think is a most businesslike one.

Alderman F. Smith (deputy chairman, Liverpool Tramways Committee): I should think it would be better to ask that three men be appointed to determine this question, because it arises in so many different cases, both with electric supply and tramways, that it would be a reasonable thing to have three technical men appointed instead of going to the House of Lords every now and again, and I rather favour the view that the Council of the Association should consider this rather than have long discussions with officials. Liverpool now has a case in which the Postmaster-General is concerned. There seems to be only "one person who is irresponsible among the human host, his majesty the general, the master of the post." (Laughter.) It is very difficult to argue with the technical experts of a Government that have unlimited power and funds. We ought to have arbitration.

Mr. J. B. Hamilton (general manager, Leeds): I rise to support the resolution which Mr. Fell has put before the conference. I have recently had some experience in this matter, and I would like to say to those gentlemen who have not had it brought home to them in the form of a writ that it is rather an appalling state of affairs to find that you have got the Board of Trade limits; you have every possible device for the safe return of your current, and yet, notwithstanding that, you have the possibility of a very considerable claim being made against you at any moment. In these circumstances the importance of the fact being brought to the notice of this conference cannot be overrated. I was partly responsible for asking that this should be done because I believe that our Association, through its Executive, can have a very beneficial effect in dealing with what has now become, and will become to many systems, a very real and very serious charge. The time since the cables have been laid by the Post-Office is not very long, and the very longest that any of them has been laid is twelve years. In many cases—and Blackpool is one—they have only been laid two years, and, as Alderman Smith said in his pithy way, the only person apparently who can lay his cables where he likes, in any way he likes, and in any form, and not bear the results of his negligence, is the Postmaster-General. The difference between the Postmaster-General and those who run gas and water undertakings is that the Board of Trade has said to us that if we do not exceed certain limits they cannot claim, but the Postmaster-General can, no matter whether you have any escaping current or not. If they say their cables have been injured, you are liable and have no redress whatever. We have been through it all just lately with the very best legal advice possible, and tramway undertakings at the present moment are absolutely helpless under that clause which was given in 1911. That being so, I think we should heartily support this resolution. I could say a great deal more, perhaps of a critical character, with regard to the methods—I am not an electrical engineer, but it is reported to me—in which they

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carry out their work, but having regard to the fact that we have got to meet them and can deal with these things when we do, I do not think we ought to go into these matters now. The plain substance of the matter is that we are absolutely helpless, and claims are now beginning. The Post-office realise their power, and with the ability to use it I think tramway undertakings can do nothing. I therefore most heartily support the resolution, and I hope it will meet with your unanimous acceptance.

Mr. C. J. Spencer (London): May I suggest to Mr. Fell that it would be well to add slightly to the resolution. The Tramways and Light Railways Association are, equally with yourselves, interested in this matter, and I am very certain, although I have no authority for saying so, that they would be very glad indeed to co-operate with you in any measures which you might find it desirable to take, and I presume that you would have no objection to this co-operation. Therefore if the resolution could be amended to this effect, I think it would be as well, because I take it that you want to call to your aid anybody who can help you.

Mr. Fell: I suggest that we should add to the resolution, "and that a copy of this resolution be sent to the Tramways and Light Railways Association with a view to obtaining their co-operation."

Mr. Spencer: That will do. I would remind you that Mr. Heath suggests that the remedy for this distressful state of affairs is an alteration of the law. I am not so sanguine that officials of the Post-office are willingly going to throw away any weapon which they may have by law even at conferences, however agreeable they may be, and I am not sure that we shall not have to take stronger measures than conferences with Post-office officials. There is no reason why Mr. Fell's resolution should not initiate further legislation.

Mr. C. Furness (general manager, Blackpool): I consider this a very delicate subject for members of the Municipal Tramways Association to discuss and have reported in the press. My opinion is that this question of electrolysis or the electrical separation of chemical compounds is one which places a great potential weapon in the hands of the Postmaster-General. I agree with the seriousness of the position, but I rather think that we are unduly alarmed because the Blackpool and Fleetwood Tramway Company have had a verdict in their favour turned against them by the House of Lords. The simple remedy in that case would have been to have bonded the lead sheathings of the telephone and telegraph cables to the earth return, and the trouble would have been avoided. It has been done now, and I put it this way, that municipalities carrying on electric supply and tramways have a far greater mileage of lead-covered cables laid under the streets of their towns than the Postmaster-General has in these particular towns. To speak of my own town, Blackpool, we have something like 250 miles of underground electric light and tramway feeders, and we have had no electrolytic trouble for the last 25 years, save this trouble which was on the Fleetwood tramway prior to its purchase by the Blackpool Corporation. One can always be wise after the event, but personally I should never have gone to law with the Postmaster-General over sixteen guineas. I would have paid the bill and said nothing more about it, and if that policy had been followed by the Blackpool and Fleetwood Company there would not have been this law on the matter that there is to-day. I hope this will be a warning to managers. I feel that the relations between the municipalities and the Postmaster-General are very happy. The regulations which are mentioned in the paper were drawn up in 1893, following a report by a joint committee, and any manager can get a copy for 2s. 6d. This report is a voluminous statement of 33 witnesses on this question of electrolytic action. The joint committee consisted of five members of the House of Commons and five members of the House of Lords. They sat for 12 whole days, with adjournments, and had before them 33 expert witnesses, with the result that the regulations which have been drafted by the Board of Trade have been in existence since 1893 without a word in their clauses being altered, and I say without hesitation that they have worked admirably. I do not say that they altogether prevent electrolysis—I mean the 1·5 volt clause—but it is a technical matter, and depends on many factors. The intensity of the current from the cable to earth is one of the most important factors, and quite as important as the potential difference between the pipe, which is positive, and the rail, so that we want to move very warily in any action, or individual action, which we may take in connection with this matter. That is why I feel so diffident in criticising the paper, because the relations between the Postmaster-General and the Blackpool Corporation up to now have been very happy indeed, and I think they are in the majority of cases. One strong reason why they should be happy is this, that we have to run quite an equal risk with the Postmaster-General in regard to electrolytic effects on our own cables, and in protecting our own cables from electrolysis we are protecting the Postmaster-General's property. In Blackpool we bond all our metallic sheathing, boxes, underground fittings, etc., to the earth return, and we have had no trouble whatever with electrolysis. I venture to say that if that practice is carried out there will be very little trouble between municipalities and the Postmaster-General. Coming to the resolution, I would like, with the mover's permission, somewhat to enlarge it. I do not go quite so far as Mr. Spencer in invoking the aid of the Tramways and Light Railways Association, because this is a municipal gathering, but I do think we should have the Association of Municipal Corporations and the Incorporated Municipal Electrical Association with us to form a composite body dealing with the matter of electrolysis which affects the Postmaster-General and the municipalities. The I.M.E.A. might provide two members and the Association of Municipal Corporations might also provide two members to form a composite committee with us, to meet the officials of the Postmaster-General, and I think that would be a step in the right direction.

The Chairman: Then you will leave it to the Executive in considering the matter?

Mr. Furness: Yes.

Mr. J. F. Cameron (general manager, Northampton): Before you put that resolution, Sir, I would like to say a word in connection with my father, who was late manager to the company taken over by the Blackpool Corporation. Mr. Furness said he would not have gone to law for £16 16s., but Mr. Furness does not know the secret of this matter. It was not a question of fighting the Post master-General for £16 16s. in connection with this special matter, but the fact was that my father was tired of electrolysis, and was determined not to pay any more money under this head to anybody unless forced to do so. But the whole question does not finish with the payment of £16 16s. to the Postmaster-General, as there was a principle at stake. There are other people besides him, and if my father had taken the attitude Mr. Furness suggests on the tramway rating cases, you would not have had the classic you have to-day.

Mr. Furness: I hope the last speaker will not think that I cast any aspersion on his father. One can always be wise after the event. This is a question of law, and Mr. Cameron's father, who was the esteemed manager of the company, was advised to take the rating case to the House of Lords. There was not the slightest reflection on your father, Mr. Cameron.

Mr. Cameron: That is quite all right; I did not take it that way. My father was advised by the lawyers not to take the tramway rating case to the House of Lords, but he did so. He was advised to do the same in this case, but did not take their advice.

Mr. E. S. Rayner (general manager, Hull): There is one small matter in connection with this paper, and that is the question of the negligence of the Postmaster-General. It seems to me that the trouble we have is to get a definition of the word "negligence." If we can get the word, as far as the Postmaster-General is concerned, defined, then our difficulties are at an end. Obviously, if the Postmaster-General put a cable across one of our tramlines, and we ran a tram over it, I do not think we could be held responsible, and my only suggestion is that, in going into this matter, if we could get a definition of the word "negligence" we should settle the matter.

The Chairman: I put the resolution, it being understood that if it is carried a copy is sent to the Tramways and Light Railways Association, so that they may have an opportunity of co-operating with your Executive.

The resolution was carried unanimously, the point raised by Mr. Furness as to the Association of Municipal Corporations and the I.M.E.A. being left to the Executive to deal with.

The conference then adjourned until the following morning.

Although the wretched weather continued, and rain was still falling as the members left the conference, many of them took the opportunity to inspect some of the cars of the Newcastle Corporation tramways department. Illustrations and a description of these will be found in THE TRAMWAY AND RAILWAY WORLD of September 14, and they comprise some interesting types. The sets of coupled cars were a novelty to many of the delegates. Each of these sets consists of two single truck double-deck cars, permanently coupled together. Only one of the cars has a trolley, but each is equipped with one 35-H.P. motor. Another notable feature is that many of the cars are provided with a front exit. The cars locally known as the submarine type presented a novel appearance. These were originally single-deck cars, which Mr. Hatton has converted to double-deck cars so as to provide greater carrying capacity. The latest type of car, which may be regarded as the standard double-deck type, has a front exit, vestibule ends, and a top cover extending the full length of the car and inside staircases.

Much interest was shown in a new power brake with which a single-deck car has been experimentally equipped for Newcastle tramways department by the Electro-Mechanical Brake Company, Limited. The brake was tested by a number of delegates on very steep gradients, and the action appeared to be thoroughly efficient. We hope to describe it at length in a later issue.

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THURSDAY, SEPTEMBER 14

The conference resumed at 10-30 o'clock on Thursday morning. Mr. E. S. Rayner (general manager, Hull Corporation Tramways) read the following paper—

TRAMWAY ROLLING STOCK.

By E. S. RAYNER, M.I.E.E.
(*General Manager, Hull Corporation Tramways*).

In view of the interesting paper on this subject recently read by Mr. Spencer before a kindred association, a second paper may seem redundant, but I felt that the subject is of such vital importance to all tramway men that it would give an opportunity for discussion to members of this Association.

For some considerable time I have given this subject serious attention, and have only been waiting a favourable opportunity to put my conclusions into practical shape, and we are at present working on a tramcar on the lines briefly outlined in this paper.

Before, however, getting to the subject matter, I think some answer should be made to the insinuation that the design of tramway rolling stock is behind the times, if we are not to sit down to the soft impeachment that we are a somewhat decadent industry.

It must be remembered that as far as tramways were concerned it has been impossible to devote any time or money to experimental work since 1914, as tramways had no direct utility from a fighting point of view, whereas motor traction, which immediately prior to the war had just begun to feel its feet, had a very large value from this point of view, and in consequence received a considerable amount of attention and expenditure to bring it up to its present state of efficiency.

There is no doubt whatever that the lessons learned in the war, from a transport point of view, had an enormous bearing on the great strides which have taken place in that industry. Everything which tended to reliability and efficiency was worth all the brains and money which were spent upon it.

Since the war our hands have been far too full settling our labour problems to leave any time for experiment or research in connection with our rolling stock. In spite, however, of all this it must not be forgotten that improvements have taken place both in our motors and equipment and in the car bodies, although it is quite correct to say that no radical change has been made in the general design. Trams have undoubtedly fulfilled, and still fulfil, a very useful purpose in a very efficient way in spite of the burdens which tramway undertakings have had to carry, which, rightly should have been placed on other people's shoulders.

Another reason for the absence of any radical change is the natural conservatism of the race. We built cars to last for many years, and they have lasted so well that there has been a great di-inclination to scrap so much apparently useful material. This same disinclination to scrap anything that will work applies to many things in addition to tramcars, and is often carried to a point where it is distinctly uneconomical.

I think we might, with profit, take a leaf out of the Americans' book, who build most of their plant with the idea that by the time it is worn out new ideas will have come along, and instead of repairing it and patching it up it will be scrapped, and new and up-to-date plant purchased to replace it, though extremes in both views are to be avoided.

Tramway Trucks.

In the endeavour to emulate railway rolling stock practice, the tramcar designer and engineer has forgotten or neglected the essential difference which exists between the resilient sleeper track of the railways and the super-solid track of the tramways. Every conceivable device is used to make the tram track absolutely rigid. I am not finding fault with this ideal—the circumstances demand it. We all know the evils of a sloppy track—the outrageous cost of repairs, the breaking of anchor bolts, and a thousand and one troubles due to a badly laid track. But the mistake from which tramways have suffered, and are suffering to-day, is that we have attempted to build our rolling stock on the same principles that we build our track. Rigidity has been our fetish. With motors weighing 30 cwt. or more fixed directly on to our driving axles, the actual unsprung weight equals 5,346 lb. Brill 21E, and the springing of the remainder falling very far short of our accepted ideal, the railway coach, in spite of the fact that they have a resilient track and trams have not. Given a length of respectably corrugated tramlines and an average car, you can have a dose of vibro-massage second to none. The trouble is that it is applied to the wrong place.

In my opinion, nearly all our troubles are traceable directly or indirectly to this rigidity together with the excessive unsprung weight on our axles and the very inadequate springing of the remainder of the tram. There must be resiliency between track and car, and until this is achieved we shall continue to have heavy track maintenance cost, and in comparison equally heavy car maintenance costs.

It is obviously impossible to have a resilient tram track, although more or less satisfactory results have been obtained by the use of longitudinal wood sleepers. The result is not sufficient to make any material difference. We must therefore provide the necessary resiliency in the design of our rolling stock.

In my opinion springing is a much neglected science, both in trams and motor vehicles.

We have been trying to overcome the effect of rigidity by rigidity—to cure the troubles caused by a rigid track by making our cars more rigid still. With what result? The weight has been increased out of all proportion to the useful work required. This again has reacted on the track, and heavier and more rigid construction has been necessary. And so the battle goes on to the detriment of tramways and the inflation of the cost of construction and maintenance.

We must have lighter cars, and that means lighter equipment. I attach a detail schedule giving the weight of each item in a Standard Brill 21E truck equipped with a G.E.52 motor and B.T.H. K.10 controllers, and if this is examined the excessive weight of the various parts is obvious.

Weight of Car Truck Parts.

Name of Part.	Weight of One.	No. per Car.	Total Weight.
Truck side frame	404 lb.	2	808 lb.
Truck top bars	130 ,,	2	260 ,,
Elliptic springs...	49 ,,	4	196 ,,
Elliptic spring top caps ...	3¼ ,,	8	26 ,,
Elliptic spring U bolts ...	1 lb. 6 ozs.	8	11 ,,
Body springs	14 lbs.	8	112 ,,
Motor suspension springs ...	3 ,,	8	24 ,,
Axle box springs	7½ ,,	8	60 ,,
Body spring top caps ...	2½ ,,	8	20 ,,
Body spring bottom caps ...	1¾ ,,	8	14 ,,
Motor suspension spring caps	2 ,,	16	32 ,,
Motor suspension T & B spring bolts	4 ,,	4	16 ,,
Motor suspension bars ...	85 ,,	2	170 ,,
Axle boxes complete with bearings	198 ,,	4	792 ,,
Wheels complete, axles, centres &c.	1,079 ,,	2	2,158 ,,
Gear wheels and key	179 ,,	2	358 ,,
Pinion wheels and key ...	17 ,,	2	34 ,,
Gear cases	164 ,,	2	328 ,,
Pilot boards	31 ,,	2	62 ,,
Pilot board brackets ...	10 ,,	4	40 ,,
Complete set of brake gear ...	616 ,,	1	616 ,,
Truck centre tie bars ...	20 ,,	2	40 ,,
All truss bars	56 ,,	2	112 ,,
Motor case complete with bearings and armature	1,676 ,,	2	3,352 ,,
Rheostats	110 ,,	2	220 ,,
Controllers	200 ,,	2	400 ,,
Cable bundles	91 ,,	1	91 ,,
Lightning arrester	26½ ,,	1	53 ,,
Auto switch	19¼ ,,	1	19¼ ,,
Car main switch	6 ,,	1	6 ,,
Choke coil	14 ,,	1	14 ,,
Main fuse	4 ,,	1	4 ,,
Trolley standard with boom complete	224 ,,	1	224 ,,
Sander magnets	24 ,,	2	48 ,,
Sander gear complete ...	65 ,,	1	65 ,,
Life-guard complete	80 ,,	2	160 ,,

The same fault applies to the body.

Mr. Munro, in his paper on "Railless Electric Traction," gives the comparative weight of double-deck vehicles per seat as follows—

Petrol omnibus ...	256·4	lb. per seat.
Railless	297	lb. ,,
Tramcar	440	lb. ,,

showing that trams are very nearly 50 per cent. heavier than railless. These figures represent a total weight of about 7¼ tons in the case of the railless vehicle and anything from 11 to 15 tons in the case of the tramcar. This weight should easily be below 9 tons.

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Mr. Spencer in his paper complains that there has been no material change in trams, and I agree with him. The motors are better and heavier; the equipment is better and heavier; the bodies are better and heavier. In fact, if a tram could talk it would Coué, "Every day and in every way I feel heavier and heavier." But the bad initial faults still remain—unsprung weight, bad brakes, overhung bodies, and the rest. I admit it is something of an achievement to carry a 28 ft. or 30 ft. body on a 6 ft. wheel base, as satisfactorily as we do, but it is wrong. In my opinion there is no reason why tramcar construction should not follow the lines of our competitor, the motor vehicle, or at any rate take advantage of any of their dearly bought experience which may with profit be applied to a tramcar. Their conditions of service are infinitely worse than ours—bad roads as compared to a smooth rail; the addition of a self-contained power unit; and last, but not least, a steering device. The outstanding feature is the small amount of unsprung weight in their chassis as compared to a tram truck. This, of course, is due to the type of drive adopted by them—the propeller shaft with its bevel or worm gearing.

I am convinced that there is no insurmountable difficulty in adapting this type of drive for tramway work. The advantages are obvious, and I think far outweigh the disadvantages. The evil of unsprung motors disappears.

If a worm drive is used the gear ratio can be increased, the speed of the motors increased, and the weight reduced. A smooth start is obtained with a comparatively low starting current. The size of your gear is much reduced, and the road clearance can be increased to safe dimensions instead of the present meagre allowance which more often than not is a minus quantity where the road is bad and smaller wheels can be used.

All this has been done, and well done, by the motor vehicle, and the latest production of the railless vehicle is a most efficient machine.

It must be remembered that the size of our wheels and the speed (which also governs the size of our motors) is governed by the comparatively small reduction we are able to get in a one-step gear.

The motor vehicle maker appreciated the value of a worm drive and spared no trouble or expense to bring it to perfection. Of course it has its drawbacks, the principal being the amount of wear which takes place between the worm and the wheel.

In practice with a heavy 4-ton vehicle the approximate mileage is 75,000 as against 150,000 to 170,000 with the ordinary bevel drive, but we require special service, that is, high speed motors, good road clearance, and less weight. If we can obtain these at a little extra cost then it is well worth the expenditure; besides, there is always room for improvement, and undoubtedly when there is a call for an improved worm drive improvements will take place.

Another bad feature of tramway work is undoubtedly the solid axle without the interposition of a differential. When you consider that in taking a right-angle turn with a 40-ft. radius curve, the distance to be travelled by the wheel on the outside of the curve is 7·46 ft. more than the wheel on the inside of the curve travels, you appreciate the amount of slip that has to take place between the wheels and the rails every time a right-angle turning is negotiated, and we are well aware of the amount of wear and tear on the rail, and there is also the torque on the axle. Nearly the whole of this could be eliminated by the use of a split axle. This can be obtained by the use of a differential or by adopting a variation of the type of axle which is used on the railless vehicle with its double worm drive and a motor for each half of the axle. This is another point on which we materially differ from railway practice, as they haven't any curves approaching this radius to negotiate, and the slip in consequence is not so serious.

Dealing with curves, as most of us are at present engaged in the reconstruction of our tracks, it is essential, in view of the longer wheel bases which are in general use, and which it would be advisable, if possible, to increase, that in putting in the new curves they should be so designed that it is possible to run these longer wheel bases, as, of course, the original curves were only put in to accommodate 6 ft. wheel base cars.

In my opinion there is absolutely no need for a check flange to be put at the curves, as the speed at which all sharp curves are negotiated renders this unnecessary, and if the check were done away with and merely a bull nose rail with a flat groove without a check were substituted for the present arrangement, it would allow of a greater variety of cars with different wheel bases passing round them with comfort, as there is no reason why a wheel should not run on the flange in going round a curve.

Mr. Wilkinson some years ago made some experiments with a differential which I believe he found to be successful in overcoming the trouble, but far too expensive to become a practical proposition, but from what I saw of this arrangement it appeared somewhat heavy, and the position of the differential on the wheel made it very difficult to keep it dust-proof and to get it satisfactorily lubricated. On the other hand, the motor vehicle of to-day has no trouble with its differential or back axle. I venture to say it gets less attention than any other portion of the car, and apart from broken axles, which are really nothing to do with the differential, gives less trouble.

It will be said that we are adding to our troubles by putting in universal joints and propeller shafts, but is there anything in this contention? The motor vehicle has very little trouble with its transmission.

It is useless to try and adopt one isolated feature of any mechanism unless you provide the essentials which go to make a success of the whole, and that brings me to another point in tramway construction—bearings.

To my mind we have not taken the advantage which ought to have been taken of roller and ball bearings, due largely to the fact that in nearly every case it would mean conversion, and conversions and adaptations are always expensive and unsatisfactory performances. (The conversion of the manager perhaps being the most difficult part of the work.)

The actual saving in friction amounts to about 20 per cent. over all that, but the principal saving will be in the decreased starting effort and the decrease in the cost of lubrication, attention, inspection, and renewal, and I am convinced that if all the tramway rolling stock were fitted up with properly designed roller or ball bearings throughout, the greasing staff could be reduced by 50 per cent., and your repair bill cut down by a similar amount, and what is more, we should have no dropped armatures or smoking axle boxes, or for that matter worn axles, and if you set the cost of the ball or roller bearings against all these items you will find that they are well in credit.

We have had ball bearings on some of our motors for years, and they have required practically no attention and show very little, if any, signs of wear.

Brakes.—Tramcar brakes badly need re-designing. I refer more particularly to the hand brake, with its heavy lever bars and massive brake shoes. The actual weight of the brake gear on an ordinary truck is about 600 lb., whereas the brake gear on a motor vehicle weighs about 1 cwt.

I see no serious difficulty in applying the ordinary internal expanding brake of a motor car to tramcar practice; we can obtain equal braking power with a fraction of the force required to operate them under the existing design. In fact, there is no real reason why a foot brake should not be used.

There is not the slightest doubt that the weight of a truck designed on these lines could be decreased at least 25 per cent., and it would allow the body to be kept very much lower than it is with the present design.

Wheels and axles are another source of weight. A set of wheels and axles with 4¼ in. axles on a single truck car weigh 2,158 lb.

Many years ago in America railway disc wheels were used with great success. The value of a disc wheel in the case of tram trucks would be the comparatively simple problem of fixing a brake drum to the inside of it.

It must always be borne in mind that while you are reducing the weight of your truck and body you are able to reduce the size and weight of your wheels and axles.

Effect of Rolling Stock on the Track.

This is an aspect of the question to which I attach a great deal of importance, but it is one which, so far as I am able to ascertain, has received little or no attention.

In the discussions which have taken place on rail corrugation it has been suggested that it was in a measure due to the rolling stock, and I think that there is a great deal in this theory, as with the excessive dead weight on our axles the wheels produce the same result in a less degree as in rolling, added to which there are the vibrations which are set up in the rails by the passage of the trams, which would tend to give the wave formation of the corrugation.

It has always been my opinion that corrugation was due to vibration and a hammering effect, rather than a pressing up of the metal; however that may be (and I certainly don't want to start our old friend corrugation for discussion), it is not only corrugation that is produced by our badly designed trucks, but the heavy wear and tear of both rails and foundations, which is due to the same cause.

It does not matter how well a track is laid, or the rails packed, nothing can stop the pulverisation of the concrete immediately underneath the rail caused by the vibration set up in the rail, which in time allows the water to get underneath the rail, and the action of pumping grooves in the foundations, which we all know so well, is started. Our only hope is to reduce these vibrations to a minimum.

I have recently taken out the car-miles per mile of rail for the whole of Hull system since it was installed, with the object of getting, if possible, some definite data as to the life in ton-miles of tram rails, and I obtained some interesting and surprising results.

On sections that it has been necessary to relay the mileage varied

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from 6,221,200 car miles in the centre of the city to 3,007,000 car-miles a mile or more from the centre. In both cases the wear and condition of the rails was approximately the same; roughly speaking, the figures showed that the wear was proportional to the average speed.

Hull is dead level, and the majority of the track was laid at the same time, so that the conditions are favourable to a fair comparison. It is difficult to give the actual mileage per $\frac{1}{16}$ in. wear on the tread of the rail due to the speeding of the head of the rail, but the reason for renewal was not altogether the wear, but the fact that we have been troubled for some time past with rail fractures, not only at the joints but in the centre of the rails, and it has taken another curious form, in the shape of longitudinal cracks, which start at the time rod slots and run along under the head of the rail so that in some cases the head is loose on the web for 20 ft. or more.

The metal is badly crystalline.

Although I use the word crystalline for want of a better, there is nothing to show in a micro-photograph of the metal that crystallisation as such has been set up. That is to say, there is no apparent difference in the actual formation of the metal itself, and it would be truer to say that the metal is fatigued rather than crystallised.

Taking the highest figure given, this means a life of approximately 80,000,000 ton-miles, and the lower figure half that amount, viz., 40,000,000 ton-miles.

It is difficult to get comparable figures for the wear of railway rails, but it has been stated by Mr. F. R. Johnston that an 80-lb. rail on the G.N. main line on a rising grade of 1 in 200 gave from 100,000,000 to 120,000,000 ton-miles with a life of 18 years.

When you consider the weight and speed of railway trains with engines of 130 tons and over, and speeds up to 70 miles per hour, and compare trams of 12 or 14 tons and speeds up to 20 miles per hour, it is obvious that there is something radically wrong. It is undoubtedly due to their resilient track that railways are able to do so much better.

I believe I am right in stating that the heavier section rail on railways does not give such good results as the lighter section, which apparently goes to prove that resiliency has a lot to do with the life of the rail.

I have here some very interesting casts of railway rails taken from the main and branch lines on the N.E.R. system.

No. 1 is a 90 lb. steel rail carrying main line passenger, goods and mineral traffic. Been in service 25 years. The loss in lbs. per yard, 6·12. The loss in depth, 246/1000ths of an inch.

No. 2 is another section of a 90 lb. rail, in service 23 years, carrying main line passengers, goods and mineral traffic. Loss in lbs. per yard, 5·21. Loss in depth, 148/1000ths of an inch.

No. 3 is a 95 lb. British standard steel rail, carrying main line passenger, goods and mineral traffic. In service, 13 years on a 25 chain radius. Loss in lbs. per yard, 6·03.

No. 4 is another section of the same class of rail, 95 lb. In service 15 years, carrying main line, passenger, goods and mineral traffic. Loss in lbs. per yard, 4·4. Loss in depth, 136/1000ths of an inch.

And lastly, No. 5, which is 82 lb. per yard, in service 43 years carrying passenger traffic on a single branch line. Loss in lbs. per yard, 7·69. Loss in depth, 276/1000ths of an inch.

We have a sample of a tramrail 96 lb., with a mileage of 4,841,100 in service on the straight for 22 years, with a loss in weight of 19·7 lb. per yard, and a loss in depth of 685/1000ths of an inch.

If you compare these sections, and the wear on them in ton-miles, you will see that the tramrail shows at least three times the amount of wear with a very much less carrying capacity.

I grant you that there are other factors in connection with the wear of tramway rails which do not apply to railway rails; nevertheless, the wear is excessive, and I think it is very largely due to the type of rolling stock we use. But apart from the actual wear of the metal, we have to consider the enormous cost of the repairs to the foundations, paving and joints, which has to be met in order to maintain our track in anything like an efficient condition.

We cannot have a resilient track; we must therefore have resilient rolling stock., The vibrations which are set up under existing conditions are no doubt responsible for the rapid deterioration of our rails.

I have not time and do not wish to weary you with other troubles, such as the eating of the rail into the foundation and similar ills, but they are all due to the same cause—" absorption of vibration."

I am convinced that with properly designed, in other words, properly sprung, rolling stock, this vibration can be very considerably reduced, if not eliminated, and the saving in the cost of track maintenance will go a long way to pay the bill.

Through the courtesy of Mr. N. Malt, district engineer of the N.E.R., Hull, I am able to show you some casts of rails showing the wear and date of laying down, and a very interesting cast of a tramway and railway crossing, showing the comparative wear of trains and trams, also some sections of tram rails.

I had hoped to give you some details of the proposed new tram on which we are working, but matters are not far enough advanced to give more than a general outline.

It has a split back axle with a double worm drive.

Two high-speed motors suspended clear of the axle.

The wheels, other than the drivers, will be free.

Drum brakes will be fitted.

Ball and roller bearings throughout.

The body will be kept low, and platform cantilevers will be omitted.

A continuous frame will carry the body.

The springing will be as easy as possible, and the weight will be cut down to the lowest possible figure compatible with safety and stability.

These are the ideals; it remains to be seen how nearly we attain them.

In this paper I have purposely refrained from giving a lot of technical figures and details; my object has been to show some of the evil effects of the present design of tramway rolling stock, and to make some practical suggestions on the lines upon which it can be improved, and principally to give the members of this Association the opportunity of discussing the subject.

DISCUSSION.

The President : I think we can say with Coué that " Every day, in every way, we are getting better and better." We may run on lines, but we do not run in ruts, and Mr. Rayner, at any rate, has shown an enterprising mind. As to the points that he has raised, I am a layman, and can say nothing about them, but it is apparent that his views are of a revolutionary nature, and aim at improving the conditions under which we work our systems. I have much pleasure in calling on Mr. Pilcher to open the discussion.

Mr. R. S. Pilcher (general manager, Edinburgh) : In the first place, I wish to congratulate Mr. Rayner on his excellent paper, and his initiative in bringing this question before the conference. I do not think there is any question that rolling stock is a most important subject, and I do not think it is too technical a question to bring before this assembly, because it is of the greatest importance that chairmen, vice-chairmen, and members of committees should follow this question, so that when managers come forward with suggestions to assist them to bring about the changes that may be necessary, they will have some knowledge of the subject, and be able to give their managers their support. We are always being twitted with the statement that we are a very conservative people on this side of " the herring pond," especially those of us who live across the border; we are supposed to be still more conservative than you are here. In Edinburgh we have endeavoured, in the last few months, to take a leaf out of the book of our American cousins, and follow, as far as we can, recent developments in the reduction of weight with regard to rolling stock. You are probably aware that in America there has been a very great development in the last four or five years; all rolling stock has been reduced in weight, and they have introduced what they call the " Birney " car. I do not think that is suitable to conditions in this country. We have top deck covers almost universally, and we cannot imitate them absolutely in that direction, but what we can do is to see what they have done, and how far we can apply their principles to our new rolling stock. Mr. Rayner deals with the question of weights, and I think it is generally agreed that if we can lighten weights it will be beneficial. He has referred to the effect on permanent way of heavy-weight cars, and I am entirely in agreement with him. We are all—I do not suppose there is any exception—in the position of having to renew permanent way. Some of us, Newcastle, for instance, have used the whole of our reserve funds in meeting these renewals, and therefore this question of the importance of track renewal comes home to us now at a particularly opportune time. If we can reduce the weight of the car, the wear on the permanent way will be correspondingly reduced. Mr. Rayner refers to the adoption of high-speed motors, the introduction of ball and roller bearings, keeping the body low, and the omission of platform cantilevers, a continuous frame to carry the body, and the reduction of all possible weight. I agree entirely with all these propositions, and we in Edinburgh have attempted to embody them in our new rolling stock. One does not want to speak too much about one's own system, but it might be of interest to the conference to hear, very briefly, what we have done in Edinburgh. With regard to the height of the car, we have reduced this from 16 ft. 3½ in. to 15 ft. 9 in. Of course we have not affected the head room inside. This reduction has been obtained entirely by reduction in the size of the wheels and by the platform arrangement. The cantilever platform has been done away with, and we have a continuous frame, which runs from end to end of the car. The effect of lowering the car is to lower the centre of gravity, and also to improve the appearance of

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the car. We originally had in Edinburgh rolling stock which had a continuous frame, and that led us to adopt it when we converted to electric traction, and I do not think there is any disadvantage in it, because it gives us a lower step, an easier staircase, and does away with that annoying step from the platform into the lower saloon. Mr. Rayner does not mention exit doors, but I am pleased to see that in Newcastle the exit door is in practice, and I should say from observation that it is a success. We in Edinburgh have adopted it as standard, and I think, before long, tramway undertakings all over the country will be compelled to adopt separate entrances and exits, because, if we can reduce the time of loading, we will reduce the scheduled time of the journey, and if we can reduce the time of the journey we will reduce our operating costs per car mile, which we are all after. With regard to electrical equipment, we have adopted as standard what most of you have had experience of, namely, the 8 ft. 6 in. wheel base—long wheel base—truck, made by the Peckham Engineering Company, and that, I believe, will have an important effect on the wear and tear of the permanent way of the future. You know that with 6 ft. wheel base cars you have that galloping action which is so very injurious to the permanent way. If you get an 11-ton vehicle, and sometimes a 12-ton vehicle, rocking on our not too good trucks, the effect on the permanent way is very great, and if you can reduce that galloping action I am sure there will be a very beneficial effect on the permanent way. With regard to light-weight electrical equipment, the Americans have adopted motors of 27 H.P. I have made a trial of several of these in Edinburgh, and as a result we have adopted a motor of 40 H.P. at 500 volts. The difference in weight is very striking. This motor weighs 1,600 lb., and compares with 1,853 lb. for a 25 H.P. motor, a gain of 15 H.P. for a reduction of 253 lb. in weight. There is another advantage with the light-weight motor, and that is that we have a clearance between the paving and the motor of 3½ inches, which is considerably more than with the standard motor. The introduction of the light-weight motor, of course, means smaller wheels, and these in turn reduce weight. I see no disadvantage in the use of smaller wheels; in fact a distinct advantage is obtained in regard to the design of the body, as it permits of the car body being lowered, and makes the step easier for the passengers. It is interesting to note the figures of the difference in weight of wheels. The 31 in. wheel is 9¾ cwts., and the 25 in. wheel 6¾ cwts., a reduction of 30 per cent. in the weight of wheels alone. The net result of the adoption of this equipment is to reduce the weight of the car from approximately 11 tons to 9½ tons, and to increase the carrying capacity from 54 to 60 passengers. The weight per passenger is reduced from 456 lb. to 354 lb.—not very much more than the railless traction car. The speed of the car has also been increased, and it is interesting to note that the Ministry of Transport is prepared to give a limit of 20 miles per hour on some of our new routes. Mr. Rayner has mentioned the question of roller bearings, and it may interest the conference to know that on examining a lot of old rolling stock on the Edinburgh system—25 to 30 years old—I discovered an old truck with roller bearings. Roller bearings have been tried consistently for 30 years. I myself have been in touch with the manufacturers of roller bearings for 18 months, and have at last succeeded in getting two cars running. It is, perhaps, not quite fair to refer to it yet, because these cars have only been running a short time, but I examined the records before leaving for the conference, and I found no reduction in current consumption. We expected to get a reduction, and it is up to the manufacturers of these roller bearings to give us the necessary equipment to do it. It is not that we managers are not wanting to try this bearing; we are anxious to do so, and the manufacturers must develop a bearing which will give us the efficiency which they claim, and the only way in which we can see that efficiency is in the current meter on the car. I am told that bearings are to cost £100 per truck. We are buying trucks for £125, so it is rather a tall order to pay £100 for roller bearings, and unless you see a reduction in your actual costs there is no use talking about them at all. The same thing applies to roller bearings on motors. We will adopt them as standard when we find some advantage, but I do know that in America roller bearings on some of the latest motors have been discarded after experience. Therefore, we have to move with great caution regarding this question. With regard to the cost of operation, I do not think there is any doubt that if you can reduce weight you will reduce that cost. Current consumption will certainly come down, as we have proved, but the chief feature of this new equipment is that you have a box frame machine of greater efficiency, and with the capillary action of lubrication you have your bearings lasting three or four years. A Newcastle engineer told me yesterday that he had some motors which had been running for four years, and had not been touched. What a difference from the old motor, which you had to take down every three or four months to renew the bearings, and yet they say tramways do not progress, and that matters are at a standstill. It is all nonsense to talk like that, because the electrical industry has been very alive, and the latest motor is a tremendous stride forward in design. If it is adopted it will mean a very great deal for tramways in the future. We have about 60 of these cars in operation at the present time, and by next summer we expect to have 250. There is one feature which is not a question of light-weight equipment. It is in connection with the latest controllers, and perhaps many of you have some of these sample controllers in use. We are specifying for all our new equipment that the controller has to be so designed that in the event of the car going back, the electric brake will act in either direction. Many years ago I had to test drivers on hills, and I found invariably that when a driver got on a hill, if he lost his head and lost control, he usually forgot to reverse his controller. Consequently, he had no brake, and therefore, we have specified that in all future equipment we shall have braking in either direction, and it is of very great value on hilly routes. I am not going to deal with many of the points which Mr. Rayner has raised, because there are those here who are far more competent than I am to deal with them, but I do not think we are going to advance in the right direction if we adopt the complications of the motor vehicle. We have a simple vehicle in the tramcar, and I think a great deal can be done with it as it is in reducing weights if we set out to do it. The car body work can be very considerably reduced in weight, and not necessarily in strength, if we introduce steel supports such as you see in the latest motor omnibus design. We have not only to tackle the question of equipment, but also the body question. The framework of the vestibule has been made as light as possible, but whether it is strong or light, if it has a collision it will smash up, and I think much improvement is possible in that direction. I trust Mr. Rayner, when he has time, will visit the capital of Scotland, and see at least most of his ideas put into practice, and if any of you gentlemen are in that district we shall be delighted to see you.

Mr. W. M. Milnes (general manager, Wigan): Mr. Rayner, in his paper, has I am sure been very successful in the main object aimed at, inasmuch as he has given us all food for deep thought, and those who, like himself, have felt that considerable improvements could be effected in the design of tramcars will receive encouragement to proceed with their efforts in this direction. In view of the articles on the experiments which have been carried out in Wigan with roller bearings on tramcars, which have recently appeared in the daily press and the technical journals, it has been suggested to me that it might be of interest to the conference if I took the opportunity to say a word in regard to these experiments. With reference to the articles in the daily press, one may be forgiven if, after reading some of them, one imagined that the secret of perpetual motion was practically solved. In self defence I must say that the information has not emanated from my department, so that I must disclaim any credit or responsibility for the accuracy of either the data or conclusions arrived at therein. On the other hand, with regard to the articles in the technical journals, it will suffice if I say that the data given were taken from the report of the National Physical Laboratory, under whose supervision the tests were carried out. I do not propose to give you a lot of detail of the data obtained in the experiments, but will touch on the main points only. The car fitted with roller bearings on both axles and motors was a double-deck top-covered car, with a seating capacity of 58, the truck being a 7 ft. 6 in. wheel base Brill 21E type, with wide wing axle boxes, and DK30 type motors, the trucks being fitted with the usual type of wheel brake, and hand-operated track brakes. Prior to the tests, both this car and a similar type of car fitted with the usual type of metal-lined bearings, for comparison purposes had been in service approximately twelve months. The results of the various tests, both with loaded and unloaded cars, were in favour of the car fitted with roller bearings. The current consumption tests with a loaded car and frequent stops showed some 22·1 per cent. reduction in favour of the roller bearings. The loads, I may say, in each case were made up of sandbags evenly distributed, and the same motorman operated both cars, but the weather was fine on the day the roller bearings were tested, and wet on the day the plain bearings were tested. The tests showed a reduction of tractive resistance in favour of the roller bearing of 20·5 per cent. at four miles per hour; 22·7 per cent. at six miles per hour; and 21·4 per cent. at eight miles per hour. These tests were carried out on a short length of straight road, with a rising gradient of 1·22 in 100, the gradient being slightly variant. The car under test in each case was hauled by the other car through a dynamometer pressure unit. Retardation tests were made at speeds ranging from 4 to nearly 20 miles per hour, and it was found that on an average the roller bearing car would run some 57 per cent. further than the plain bearing car, after the supply of power was shut off, taken at the same speed, the tests being carried out on a piece of track some 500 ft. long, having a down gradient of 1 in 71·5 for the first 400 ft., and 1 in 158 for the remainder. As to the starting effort, tests were made to arrive at the initial effort to produce motion in each car, and on the average of a series of tests it was found that the roller bearing car showed a reduction in effort of 94 per cent.

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Mr. Rayner: Does that mean that the difference between the normal running current and the actual starting current in the case of the roller bearing, as compared with the plain bearing, was 94 per cent., i.e., your curve at starting above your normal is 96 per cent. better?

Mr. Milnes: Perhaps if I explain this a little more fully it will be better. Determinations of the initial effort required to produce motion of the cars were made in the following manner. The car under test was connected through the dynamometer and a pulley block to another car, which was securely held by its brakes. The tension of the free tackle rope was gradually increased, until the towed car just began to move. The mean values of the starting effort have been determined, and the roller bearing car showed a reduction in effort of over 94 per cent.

So much for the results obtained under the tests, which naturally were carried out under the best conditions of supervision and tuition of the motorman; but what will, I think, interest the conference more is the actual result which we have since obtained in normal working, i.e., during the last nine months. The current for both cars was metered, and the results show a very wide difference with different motormen operating the two cars. The difference in favour of the roller bearings car was as high as 16 per cent. on some occasions, and on others as low as 2 per cent. Taken, however, over a period of six months, I find that the average result is 3·5 per cent. in favour of the roller bearings on total current consumption. This difference in the operating costs is, to my mind, accounted for mainly by the fact that we have only one car with roller bearings in operation, and this is handled by some 30 different motormen each month. If, however, the whole of our cars were so equipped, from the observations I have made I have no doubt that an average result would be a 12 per cent. reduction of current, owing to the men becoming more accustomed to the cars, and so taking advantage of the greater coasting propensities, which are a marked feature of the car with roller bearings. With regard to maintenance, we have opened up the bearings for inspection every four months, and so far have found no sign of wear, the oil on each occasion being found to be clean, of good body, and apparently fit for another four months' running. From now on we shall examine them half-yearly, and I do not see why the inspection should not be an annual one. This will, I estimate, reduce lubricating costs by at least 50 per cent. on this car. With regard to the cost of conversion, I have recently been supplied with some figures, and from them I estimate that the cost of converting the Brill wide wing axle boxes would at the moment be about £100 per set of four axle boxes, and for the DK30 motors the cost of the bearings would be about £10 per motor. To these figures must be added the cost of new motor bearing housings, and machining of armature shafts and axle journals, or, if not suitable, the provision of new axles and armature shafts, making a total cost per car of something under £175. A 3·5 per cent. saving, however, is going to take a long while to give us back that £175, and that is the trouble when considering conversion. If we can get it up to 12 per cent., and reduce lubricating charges by half, the proposition will be more hopeful. Owing, however, to the financial position in Wigan, we are not at present proposing to change our existing bearings, but I am sufficiently satisfied with the results to say that I should certainly specify roller bearings if I were ordering new cars. My own conclusions are that the question of obtaining a material saving in current would depend mainly on two factors—(1) Having a high percentage of the cars operated fitted with roller bearings; (2) the scheduled speed of the service, i.e., if a high scheduled speed were maintained with frequent stops, the resulting saving would be less than with a moderate speed and fewer stops, owing to the impossibility of taking full advantage of the increased coasting possibilities of the car; or, to put it another way, the saving will be greater on suburban routes than on city routes with frequent stops. Before sitting down there is one question I should like to ask Mr. Rayner, and that is what effect will be produced on the position of the centre of gravity of the car by reducing the weight of the trucks and equipment, after allowing for the anticipated lowering of the body, particularly during the summer months, when the tendency is so often for passengers to ride on the top deck in preference to the lower saloon. This point would seem to me to need very careful and exact investigation, more particularly on systems with less than 4 ft. 8½ in. gauge. No doubt he has taken it into consideration, and I shall be very glad to hear what he has to say on the point.

Mr. C. Owen Silvers (general manager, Wolverhampton): I should like to congratulate Mr. Rayner on his very effective reply to that iconoclast, Mr. Spencer. With regard to worm gears, Mr. Rayner is far too modest in putting forward the figure of 75,000 miles. I have had worm gears on heavy motor vehicles for a considerable time, and they have run more than 100,000 miles, and are still giving good service. In spite of that, however, I think very much could be done with the more efficient chain drive. To my mind the worm drive that we have on motor vehicles is merely a fashion, and as the chain drive is developed we shall get better and more efficient results than with the worm drive. I am doubtful as to the wisdom of introducing the complicated differential gear on a tramcar, and with the small number of times that we have to turn round 40 ft. curves, I think it is perhaps unnecessary. I would suggest, however, that when designing a new car such as Mr. Rayner suggests, we might think more seriously of adopting the single deck car with a high centre of gravity, which would mitigate wear on the track. Moreover, with such a car running with trailers, I should have no fear of competition from any other known form of transport. With regard to the interesting sections of rails shown by Mr. Rayner, illustrating the difference in wear between railway rails and tramway rails, I think that a great deal of the extra wear on tramway track is due to the grit and mud, and not to the bad design of the tramway car.

Mr. C. J. Spencer (London United Tramways): I should first like to add my tribute of thanks to Mr. Rayner for this very excellent and able paper. If I might claim just a little reflected glory, I would say that I feel very satisfied indeed, because I feel that this is to some extent the first fruits of a paper I recently read myself at Bournemouth. I do not propose to go into details, because I find myself very largely in agreement with all that Mr. Rayner has said, and I do not think that one need, at this conference, discuss at any great length pure technicalities. I really want to get at something practical. You must remember that this has a good deal in common with our discussion yesterday. We are all wanting cheaper fares, and nobody wants to depress wages, and the only way that we can achieve that desirable goal is in modifying our methods of operation and in cheapening our costs in some new way, and not in the old way of going back to what we did, say, 10 or 15 years ago. The discussion this morning has shown, I submit, that there are many men who are exceedingly competent to meet from time to time and discuss such questions as this, and definitely to arrange for something to be done. Therefore, I want to suggest, if I may, that now is the opportunity to set up a committee, not necessarily composed of members of the Executive Council, but composed of members of the Association, who should be selected for their special aptitude. This committee might include representatives of the Tramways and Light Railways Association, which is just as anxious as you are to deal with this matter, and this committee might be empowered to meet a similar number of men on the manufacturing side of the industry. After all, most of us are managers. Mr. Rayner, for instance, manages a large tramway undertaking, and I am perfectly certain that this sort of thing has to be put on one side many times because other matters are urgent. The manufacturers, on the other hand, are concerned all the time with this sort of thing, and a few hints in the right place would, I think, bring forth good results. Therefore, I would like to suggest that it be referred to the Executive Council to appoint a research committee, a committee concerned with new things. I think I can say unofficially that the Tramways and Light Railways Association will be very glad to join with you in this matter.

Mr. Ben Hall (general manager, Halifax): I think Mr. Milnes of Wigan, and Mr. Pilcher, have covered most of the ground, so that I have little to say, except to thank Mr. Rayner for his very interesting paper. With regard to car bodies, I think the question of the all-metal body has not been sufficiently considered in England. There is no doubt that a more efficient and cheaper construction could be obtained in that way. With regard to top covers, I think the lighter alloys could be made use of to lower the height of the centre of gravity of the car, and so add to the safety of the travelling public. With regard to the unsprung weight of motors on axles, I suggest it is possible to introduce a four-point cradle suspension, and remove practically 90 per cent. of the weight of the motor from the axle and retain the axle suspension bearings simply as a guide to the gear centres. I do not agree altogether that Mr. Rayner's researches in the direction of the worm drive are going to be to the advantage of the industry. I think the cost of maintenance will be far too considerable. I think the results that have been shown by the experiments carried out by the National Physical Laboratory at Wigan are quite sufficient to justify the cost that was incurred in carrying out these experiments. They certainly give us some ground to work on in future experiments. The roller bearings as applied to Wigan were the result of Hoffmann's efforts, and there is no doubt the results do give us some food for thought in the future.

Mr. P. Priestley (general manager, Liverpool): I will not go into technical detail with regard to this paper, for which we are greatly indebted to the author, but the trend of the paper is more with regard to the relation between the present rolling stock and the track, and in this discussion it seems to be the aim of everybody to reduce the weight of the truck. I should like to say that this might be looked at in another way. In dealing with road vehicles it is the aim of the authorities to make the roads suitable to take the increased weight of these vehicles, but I want to know whether it has been considered, as we have done in Liverpool, from the point of view of increasing

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the weight of the track and putting metals down to stand the heavier cars. This question has been gone into very fully in Liverpool, and we have put down a track which is heavier than any other that I know of. It is a 130 lb. girder rail, with a very deep groove, and thick tread. We also find that with the ordinary wear of cars, wheels and track, you do not get the wear in relation to the British standard. The British standard rails are 1 in 21, but if you have gone into the question of the wear of rails in relation to rolling stock and wheels, you will find they finish up at 1 in 11, and we have increased the life of our rails and the life of the car by putting all our new rails 1 in 11, instead of the British standard 1 in 21, and increased the weight. These are laid where possible on sleepers. With regard to the resiliency of the track, Mr. Rayner makes comparisons between railway and tramway track. We are out for a resilient track, and I think we have gone very far to prove that with a resilient track on sleepers we lessen the wear and tear on the rolling stock very considerably. We have had running in Liverpool for about seven years three miles of track built on the railway principle, without any flanges to the rails. We have a speed on that track of 20 miles an hour, and it is possible to attain 25 to 30 miles an hour. We have little or no trouble whatever, and the cars running on that section cost very much less for maintenance than cars on any other part of the track. We are also going into it in very many other parts of the town, and are not taking into consideration trying to lighten the cars; in fact, I think we are going the other way, we are rather making the trucks heavier, and I do not think I am the only one in that respect. I think Mr. Fell is very much increasing the weight of the L.C.C. cars, and putting on motors of about 80 H.P.

Mr. Fell: Two 60-H.P. motors.

Mr. Priestley: Thus in one case we are attempting to reduce the weight of the car, and others of us are increasing our weights, and in considering the close relationship between the track and rolling stock, which Mr. Rayner has pointed out, we should bear this in mind in order to lay tracks to meet the present demand made by the heavier rolling stock, because we must recollect that some of us are increasing the weight and size of our cars. With regard to the wear on the track Mr. Rayner gives figures dealing with railway track and tramway track, but may I say to Mr. Rayner that we cannot take figures like that. I do not think they are to be considered, because on a railway track you have no vehicular traffic over it, and from experiments that I took out on a length of track which was not used by any tramcars at all, I found that there was more wear and tear on the rails than there was on track in regular use. With regard to rolling stock, I am very much indebted to Mr. Rayner, having had a chat with him about his proposed new car, and I told him candidly, in criticising it, that I did not think it would work. I do not think we are on the right lines. Mr. Rayner is making one driving axle, and that might be all right if he is always dragging his weight. When he comes to push the weight, 14 or 15 tons, and I understand he is only going to brake on the four bogey wheels, I am inclined to think he will get a buckling action, and the tendency of the truck, when it is being pushed, will always be to go off the track. I may be wrong. With regard to the worm drive, whilst I am very anxious indeed to see the experiment carried out, I think with the truck, as we have it at present, if it could be driven with a differential gear, or with loose wheels, which I think is the ideal principle, we should get over a lot of our troubles. With regard to roller bearings, candidly I was not struck with the laboratory tests carried out on the Wigan system. They were not made under actual working conditions, and the human element was not taken into consideration. In Liverpool we have had ball bearings on axles for eight years, and no saving in current is shown. We have cars with the latest Hoffmann bearings, and, unfortunately, I have not at the moment any photographs with regard to them. But with regard to motor equipment, I certainly do think that you show a vast improvement in your costs of maintenance by having roller bearings in the armatures. You overcome what we engineers and tramway managers know as the trouble of armature drop on to the pole pieces. With roller bearings I have not found the slightest trouble over a period of two years, and you do not have to depend upon a man putting feelers in to find how low the armature is going down. In Liverpool we have a truck which I had hoped to show you photographs of, but it is built on rather different lines from Mr. Rayner's, and is an attempt to get over the troubles we are having with rolling stock. I hope at a future time to be able to go into this matter. I think, with Mr. Spencer, that something might be done by meeting together, but at the same time it goes back to the same question that cropped up yesterday—each undertaking must be taken under its own conditions. Mr. Rayner is running a system in Hull on an absolutely level track, with a different type of rail, and under entirely different conditions from those we have in Liverpool, so that I do not think that meeting together like that would have very much effect, and if we are going to meet the manufacturers, I do not think that will help us much. Messrs. Hoffmann have put out a bearing which is a most elaborate one, and will cost about £100 per car to equip. When you come to go into it from the engineering point of view, I think they might simplify it, and I do not think it will be vastly used for tramcars with the present arrangements. If each individual manager and engineer will consider his own undertaking and his difficulties, and go into the question, I think he will find, on his own initiative, that he can save a lot of his troubles both on cars and on track.

Alderman T. Canby (chairman, Huddersfield Tramways Committee): Mr. Rayner referred to experiments tried in Huddersfield by Mr. Wilkinson with a differential gear. Our experience with that gear was a very costly one, and I do not think Huddersfield will be ready to tackle anything of the sort for a very considerable time, at any rate, with the present members of the Committee. Mr. Wilkinson thought there was something in it, and he convinced his Committee that there might be something in it. We wanted to get something that would be an advantage to the tramway service in Huddersfield and anywhere else, and we gave Mr. Wilkinson permission to have a number of cars fitted with that differential gear. Unfortunately, it did not achieve the object which Mr. Wilkinson had in view. One great point was corrugation, and he thought this car might overcome that troublesome fault. Unfortunately on examining the line we found that there was very little benefit. With regard to the curves to which Mr. Rayner refers, and for which he thinks his car will be a good thing, there are so very few curves that it really does not matter a great deal, and I think that is the only advantage with regard to the differential gear. As to the worm drive, I believe Mr. Blackburn, our manager, and a local firm, have this matter in hand, and they are trying some experiments. If the various experiments which are being tried could be brought together before a Committee, as Mr. Spencer suggests, so that we need not all be going in different directions, I think it would be better, and it is up to every Corporation to do something if they possibly can, especially if they have an energetic manager who is perhaps a little bit in front of the times, to help forward the tramway movement, and assist in reducing the cost of running our cars. Even if we only get one success out of ten, we shall have gained something, and I hope Mr. Rayner will achieve the success he has in mind, and evolve something which will be of real benefit to tramway undertakings.

Mr. A. R. Fearnley (general manager, Sheffield): I desire to tender my congratulations to Mr. Rayner for the very interesting paper which he has put before us. Whether we agree with him or not, we can at any rate admire his courage in putting forward many of the revolutionary suggestions set out in the paper. If I read the paper correctly it is, to sum up, a comparison between present tramway methods and the methods of motor traction; hence the little box of tricks we have on the table. On that point, I desire to join issue with Mr. Rayner, and to say that I am generally in disagreement with the ideas that he has put forward. I contend that the efficiency of the present-day tramcar is considerably higher than the efficiency of the present-day motor vehicle (hear, hear), and although at the present time the cost figures are somewhat in a state of flux, if we take the 1914 tramcar figures I would ask where you can find any other vehicle that, under similar conditions, at that time could give you the service which was obtained from a tramcar at ½d. per ton mile. That was in 1914.

Mr. Rayner: That is the point.

Mr. Fearnley: If we take these costs to-day, and say they have doubled, then the figure is 1d. per ton-mile for the 1922 accounts. What other vehicle can we find which will give such little lost mileage, and give also such few breakdowns? Again, I say it is not to be found in the fittings which have been advocated by Mr. Rayner, and I speak with considerable experience of both classes of vehicle. Dealing with the question of roller bearings, I would say that we have had them in actual daily operation for perhaps a year and nine months, and my position is exactly the same as Mr. Pilcher's. We have failed to obtain any advantage from them. The consumption of electrical energy per car-mile to-day is at least as high on the roller bearing car as on the plain bearing car. The cost of the boxes was £80 per set. We told them we could not afford to pay because we could not get the saving, and unless some great improvement can be brought about by the people who are putting forward this class of bearing, so far as Sheffield's existing tramcars are concerned, their use is entirely out of the question. Mr. Rayner says that we might, with profit, take a leaf out of the American book. I submit, with great respect, that we have taken too many leaves out of the American book. We have had American tramcar trucks on our streets far too long, and we have something much better in this country. We have a gentleman here with us who, for many years, has given special attention to the bogie truck for tramcars, and I have not seen anything to equal the Burnley tramcar truck if you want a bogie truck. There is nothing in American truck design which I have seen which beats it. I suggest Mr. Rayner has made a mistake in the heading of one part of the paper. It should not be tram "trucks"

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it should be tram "tracks." That is really what he is discussing, and finding fault with. He says that, given a length of respectably corrugated tramlines and an average car, you can have a dose of vibro-massage second to none, and then he goes on to say that it is applied in the wrong place. (Laughter.) He should have added that the usual bad joints and bad crossings and special work, together with corrugations, will give you the result which he mentions. I suggest we have there matters which we should consider equally as important as the vehicle. With regard to laying tracks on longitudinal wood sleepers, our experience is that if you do this, and lay your sleepers in concrete, the results are quite unsatisfactory. The moment the sleeper begins to move, you cannot maintain your surface between the rail and the road, and no amount of repairs will assist you in maintaining that for very long. In the paper we have the weights given by Mr. Munro in his railless electric traction paper, but my experience is that the petrol omnibus cannot provide you with a satisfactory vehicle at 256 lb. per seat. Our experience is that that should be increased by nearly 50 per cent.; you have to have a weight of about 350 lb. per seat to give a satisfactory motor omnibus vehicle. Then if you reduce the tramcar weight per seat to what has been our own experience—and I think also the experience of some of my friends—you have a figure of 395 lb. for the tramcar, against 350 lb. per seat for the omnibus, and that is all the advantage that I am prepared to concede in regard to weight. It may be that these petrol omnibus figures are London weights, and if they are they are not of any use for our purpose. Mr. Rayner says that Mr. Spencer complains that there has been no material change in tramways, and he agrees with him. I submit, with Mr. Pilcher, that there have been many changes for the better, and very many improvements in detail in tramcar construction and equipment. Many of them have been going on rather quietly, but nevertheless they have been made, and they are very effective. If you say there has been no general change in the general shape of a tramcar I agree with you, and perhaps Newcastle will agree that there has been no material change in the shape of a boat, and I think, with great respect, that that would be equally as effective criticism. The same could be applied to a railway train or a railway truck. Generally speaking, the outlines remain the same, but the details have been vastly improved. We have a greatly improved truck, greatly improved motors—thanks to the efforts of the electrical manufacturers—and we have also great improvements in the general fittings on the cars, and I deprecate this general suggestion that tramcars are not keeping ahead of the times, and that we are not maintaining our position. Mr. Rayner refers to bad brakes. I wonder where all these bad brakes are, and why we do not have more details of them. Personally, again I join issue very seriously. I say there are on the market at least three very satisfactory and efficient power brakes for tramcars, and why some of them are not adopted I do not know. Then with regard to the 28 ft. or 30 ft. body on a 6 ft. wheel base, we have not been doing that for twelve years. I venture to say that if the type of brake which is suggested by Mr. Rayner were adopted, and if we were to re-design the tramcar brake and adopt the drum type of brake, we should be in for serious trouble. We should not get nearly the life out of it, and should be put to considerably more expense. Moreover, to talk in 1922 about a foot brake for the tramcar, really I suggest that it is quite out of date. We want a brake on a tramcar that can be operated with one or two fingers, and no more, and with no more effort, and there are satisfactory and efficient brakes which are in operation to-day which can be worked in that way. Mr. Rayner then states that "Many years ago, in America, railway disc wheels were used with great success." They were used on steam tramways, and scrapped because of the noise; they are the noisiest type of wheel that you can put into operation, and we discarded them largely on account of the noise which they made. If we follow the suggestions in Mr. Rayner's paper, and adopt differentials, worm drives, drum brakes, stub axles, split axles, and other miscellaneous equipment, we shall considerably add to our costs of operation, and we shall certainly not be able to carry out the ideals which we were discussing yesterday, namely, reduced fares to the passenger. I agree that there is room for considerable improvement in the tramcar, and there always will be, but I submit that it will not be on the lines indicated by Mr. Rayner. I contend that the present tramcar is a reasonably efficient machine for the work it is called upon to do, and, given a reasonable track, it will operate at a reasonable cost.

A Delegate: There is one thing which has been forgotten in connection with ball and roller bearings, and that is the position should they break. My experience with motor vehicles is this, that the splitting of balls and the breaking of rollers is one of the chief expenses in the motor business. I would like Mr. Rayner to tell us something about his experience with these things. I would like to say that I think this has been the best conference which I have attended during the last four years, for the reason that the laymen have been wise enough to let the technical men do the talking.

A Delegate: Will Mr. Rayner give us some information about his worm gear? It seems to me that the discussion has been almost tied down to roller bearings. Perhaps Mr. Rayner will tell us something about the worm gear, which, to my mind, is the crux of the whole question before us.

A Delegate: Mr. Rayner has spoken of the rail head breaking away for a considerable distance, and I would like to ask him whether it is not due to the fact that the rail has a centre groove. For a year or two I was resident in Hull, and I noticed in the morning, after rain, that the first car was usually only running on one side of the rail; the tread on one side only was being used, and it was not always the same side. Does Mr. Rayner think that the breaking away was due to first running on one side and then on the other, and the pounding action that was going on in consequence?

Mr. Rayner, replying to the discussion said: I was warned what to expect, so that I have not been disappointed. (Laughter.) Mr. Pilcher told you—and I hoped he would—something about his new design of car, and the reduction of weight, and he says that the weight of the motor, i.e., a 40 H.P. motor, has been reduced to 1,600 lb. I omitted to say, with regard to the weight of the motor that we propose to use, that it has been reduced to 850 lb., with a speed of 1,150 revolutions per minute. Mr. Pilcher also says that he has reduced his car weight per seat down to 354 lb. I cannot speak very definitely about that, but I think we shall get a little below that figure; I am hoping so. There is one thing about the lighter car, and that is if you are going to get a lighter car you are going to get very much easier braking; you have so much less mass to pull up. In connection with roller bearings, there has been a great deal said about the efficiency or otherwise of them. If you notice, in my paper I particularly said that I did not consider that efficiency is the sum and substance of the whole thing. It is not altogether a question of 3·5 per cent. or 20 per cent., nor is it a question of 90 per cent. in the starting. That is a good thing, but I do not consider that the principal advantage of roller bearings is in efficiency. I consider that it is in maintenance. Mr. Milnes gave us the figure of 3·5 per cent. as the average saving in current consumption, which figure, you must understand, was taken under absolutely unreliable conditions. He has a new type of car, and men who are unaccustomed to driving it, and then he gives a figure of saving in current consumption on one car. I do not think it is fair to take the figure of 3·5 per cent. as being the overall efficiency figure. It is taken on one car, with unskilled men, and with different men driving it, and it cannot be regarded as anything like a reliable figure. There is no doubt about the laboratory tests, if you like to call them so, which give an approximate average of 20 per cent., and I think that is nearer the figure, although Mr. Milnes takes 12½ or 15 per cent. as being the net result. But that is only the question of power saving. It does not include his cost of maintenance. Mr. Milnes says that he only inspected the bearings once in four months, that he has reduced that to a six months' inspection, and hopes to make it a twelve-month inspection, and I think that is where you will get the saving in roller or ball bearings. Mr. Pilcher and other speakers have said that I have stated that there have been no improvements in tramway equipment. I have never said anything of the sort. What I said was that there have been no radical changes, and there is a vast difference. There have been improvements; we have got very much more efficient motors, we have got very much more efficient equipment, although some of the old equipment will take a lot of beating, for instance, the GE52 motor. I do not think there is a manager who will say that there is a better motor on the market. As a matter of fact, I bought all Mr. Fearnley's, because they were rather small for his hilly work, but are very excellent for a flat town like Hull, so that I do not think you can quibble with the statement that there has been no radical change. With regard to the difference between the results in Edinburgh and what we hope to achieve, it is in the doing away with the unsprung weight. You are not doing away with it here; you have reduced your motor weight from something like over 2,000 lb. to 1,600 lb. I agree that that is an achievement, and I think it is a step very much in the right direction, but you still have your unsprung weight. I am only expressing my own opinion when I say it is this unsprung weight which is hammering at the track and doing the damage. Another point raised by Mr. Milnes was the effect on the centre of gravity by keeping the body down. It is obvious, if I am keeping the body down I am also keeping the centre of gravity down, and I am achieving what is wanted. Mr. Silvers raised the point of worm gears. He first said that he got 100,000 miles out of the worm gear, and then he condemned it, and said that we should have single deck cars, and that he would rather have a chain drive. If you go into the question of applying the chain drive, and still doing away with your unsprung weight, it becomes a very, very difficult proposition to support your motor. The simplest motor suspension is achieved with a worm drive, because you get a very simple connection on to your axle. Another point is that you still have to

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get your gear ratio, and you are still going to have your reduction, that is, you retain your large wheel on your axle, which is going to reduce your road clearance, whereas with the worm drive, as I have stated, you can get about 10 inches clearance underneath your gear casing with a 32 in. wheel, and I do not think there is any other form of reduction gear that is going to give you that clearance, except perhaps the double reduction gear which has lately been introduced on omnibuses. He also raised the point with regard to the wear of the track. I quite agree that the wear on the tram track is partly due, though not altogether, to the grit on the track. They do not suffer to anything like the same extent on a railway from grit on the track as we do on a tramway. Then you have horse urine, and other things which you do not get on a railway, and the track suffers in consequence, but the principal trouble with the track—I think I am right, and I shall want a very much stronger case against it than has been made out this morning if I am to be convinced to the contrary—is due to that vibration which is set up by the dead weight of your axles and your heavy trucks, and it is these small vibrations which are the cause of one of your principal costs in running your tramways. I cannot agree with Mr. Priestly in increasing the weight of the track and of the cars. He says he has a 130 lb. rail. We are using a 112½ lb. rail; we are increasing our rail, we are increasing our foundations, and then Mr. Priestly says you should increase the weight of your rolling stock. Why? If you can get a light rolling stock, I do not mean a paper box affair, but a substantial light car to carry your passengers, why put on a heavy car, with all the necessary complicated braking arrangements which are going to wear your track again? In other words, why do you want to pull up 20 tons in 20 yards when you can get a car weighing 12 or 14 tons loaded to do the same work. I think in putting a heavier track in, and then putting heavier rolling stock on this, you are still going to have your vibrations, due to a fixed rail and a solid track, and the pulverising action will continue. You are then going to have that powerful hydraulic action, and your track costs are going up and not coming down. With regard to sleeper track, I agree with everything that has been said, and it bears out what I say in my paper. We have about 2½ miles of sleeper track in Hull, and Mr. Baker and several other people who have seen it agree that it is in magnificent condition, and it costs us practically nothing to maintain in comparison with the rest of the track. Sleeper track is the proper thing, but you cannot have it in the centre of cities.

Mr. Priestly: It is in the middle of ours.

Mr. Rayner: If you have a wide road, you can afford to do it, but in the average city you cannot. Mr. Fearnley disagrees with everything. It is just as well, because if we all agreed we should not get anywhere. Mr. Spencer suggests a research committee and that we should ask the manufacturers to help. I think there is a great deal in that, but it wants thinking over before you rush into a thing like that. I think we ought to have a small committee to save one another a great deal of expense, because there is no doubt that in experimental work one must experiment along one line and another along another line, but if we have no opportunity of comparing results we may be doing work twice or three times over. Mr. Hall suggests metal car bodies, but I am afraid they would become rather noisy; I think wood is all right up to a certain point, if strengthened. I suggest that if we are going to have a lighter body we might have it reinforced with sheet steel. I think that would help us very much. I do not much lean towards a metal body altogether. One speaker said I had not told you anything about the body. The fact is I was interested in the truck, and wrote at such length about it that discussion of the body had to be omitted, and that is the reason. But the general lines of the body that we propose to adopt is that there shall be a double entrance and the driver right apart from the entrance, i.e., the passengers getting on to the tramcar will not be mixed up with brake handles and that kind of thing, and I do not think it is wise always to fight for the last seat. Quick exit and quick entrance are much more valuable than a couple of seats in a car, because if you can save three-quarters of a minute in loading and unloading, and you do it for a large number of cars in a day, you get an infinitely greater carrying capacity out of them than you do by having an extra seat or two just to carry the passenger in a rush time. Mr. Fearnley says that he does not like this mud slinging at tramways. There has been no mud slinging as far as I am concerned. The only difference of opinion as far as Mr. Fearnley and myself are concerned is that there has been no radical change. I have no complaint to make of the improvements in motors, the improvements in controllers and so forth. Great improvement has been made but it has been along the same lines. Mr. Fearnley says that if we compare the figures of 1914 for omnibuses and for tramways, they show that the omnibus people have not a look in. I agree, but we are in 1922 now and not 1914, and they have had eight years unlimited expense in the construction of their vehicles, on the composition of their steels and so on, whereas tramways have not had that advantage, and we all know the reason. I say that the omnibus, for the service it has to perform, is a wonderful vehicle. (Hear, hear.) It has to go over pot-holes 3 or 4 inches deep and has to do it every day, and if you put a omnibus equipment on a smooth running tramway rail, then I am convinced that under the same conditions the 'bus equipment will do quite as well as the tramway equipment of to-day, and you will have a lighter car. Mr. Fearnley also does not approve of roller bearings. It is the old mistake, that because you cannot pay the whole cost out of your decreased power cost, roller bearings are not a paying proposition, but it is not entirely in your power that you are going to get your advantage; it is in your maintenance. He also complains that I say we should take a leaf out of the American's book, and also that we have got far too many American trucks. I did not say take a truck out of the American workshops; I said take a leaf out of the American's book, and that meant that we should discard antiquated plant and put in efficient plant to do the work we want, and we shall save money by doing it. That is not buying American trucks. In regard to longitudinal wood sleepers, Mr. Fearnley agrees with me. We put in wood sleepers and we got practically the same result and came to the same conclusions that Mr. Fearnley has. The trouble is that you cannot keep your longitudinal sleeper sufficiently staid to keep your road surface good with regard to the top of the rail. I have already said that if you can put in the transverse sleeper of the railway type, do it every time. That is the whole crux of the paper. I think, also, that the track people might pay more attention to drainage and that would help us a bit.

The President: I do not know whether the time is ripe for appointing a committee such as Mr. Spencer suggested, but there is one thing I am sure you will agree and that is that the author of the paper has shown the qualities I asked for in my address, vision, conviction and courage. Let him carry on his experiments and next year he will be able to tell us something more for our benefit. I ask you to accord him a hearty vote of thanks.

The motion was carried with acclamation, and an adjournment was made for luncheon.

WEDNESDAY AFTERNOON

"HIGHWAYS" COSTS BORNE BY "TRAMWAYS."

By H. MATTINSON, A.M.Inst.C.E.
(*General Manager, Manchester Corporation Tramways*).

The subject of my remarks to you to-day has been written about and discussed *ad nauseam* for years. It was admirably expounded by Mr. Chamberlain in his paper at the last conference, but as Mr. Rayner remarked in his contributed discussion, no solution was indicated, and the discussion, being only contributed, did not lead to any effective result.

Mr. Rayner, I notice, has returned to the attack in the current issue of THE TRAMWAY AND RAILWAY WORLD, and my only excuse for pursuing the subject is the persistency of our secretary and his desire to come to some definite settlement.

I propose first to present a brief recapitulation of the subject to bring the chief points again clearly before you.

Our liabilities are set forth in the Tramways Act 1870, the essential clauses being the following—

Section 25.—Every tramway . . . shall be laid and maintained in such manner that the uppermost surface of the rail shall be on a level with the surface of the road. . . .

Section 28.—The promoters shall, at their own expense, at all times maintain and keep in good condition and repair, with such materials and in such manner as the road authority shall direct, and to their satisfaction, so much of any road whereon any tramway belonging to them is laid as lies between the rails of the tramway and (where two tramways are laid by the same promoters in any road at a distance of not more than four feet from each other) the portion of the road between the tramways, and in every case so much of the road as extends eighteen inches beyond the rails of and on each side of any such tramway. . .

Under these sections we are—

(1) To provide the "highway" formation for the width of our tramway and 1 ft. 6 in. beyond, which on an average may be taken at some 50 per cent. of the total area of a road along which a double line of tramway is laid.

(2) To maintain such "highway" formation so long as the tramway exists, and particularly to do so in accordance with Section 25.

(3) To reinstate the roadway, in the event of the tramway being abandoned, to as good a state as it was before the tramway was constructed.

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These conditions, imposed when all tramways were horse-hauled, were just and reasonable. It is the introduction of electric traction which has altered the circumstances and which renders a reconsideration of the obligations necessary, and it is the use of this "highway" provided by the "tramways" by irresponsible motor omnibus competitors that aggravates the injustice.

Our object therefore is to claim relief from those obligations that are in common equity and fairness chargeable against highways authorities.

In this we must not be too grasping, but must limit our demands to items we can substantiate in every particular.

In essence we claim relief from the liabilities imposed on tramways by statute in respect of highways construction and maintenance (of which highways the tramways form an integral and inseparable part) in so far as such highways are not used, or may be unnecessary for tramway operation.

To ascertain what part of the roadway may be considered purely tramways and what part purely highways we must consider our respective identities.

The tramways require a rail, held by tie-bars and supported by an adequate foundation.

This foundation will naturally vary somewhat with the subsoil, but generally speaking a stringer 1 ft. 6 in. in width and 6 in. thick has proved adequate—the rail, packed on this and held by tie-bars, constitutes our "structure." All the rest is "highways."

I consider therefore that where the concrete and paving extend in common the full width of the road, the whole cost of such "highway" construction should be debited against the highway authority in so far as they are saved such cost.

It is not practicable for the two entities to be constructed separately, and it will often occur that the character of highway existing is not suitable for the tramway, i.e., macadam, grit paving, etc.

In the event of the roadway in question not requiring concrete foundations or paving for the general traffic thereon, it is obvious that, in common fairness, the Local Authority cannot be charged with the cost of a type of construction called for by the laying of the tramway. If in course of time the Local Authority should reconstruct the sides of the road, a contribution should then be made towards the cost of the original tramway area based on the cost of such reconstruction.

As regards maintenance, I do not see that we can escape this, nor ought we to attempt to do so. The obligation is ours under Section 25, to keep the surface of the roadway level with the rail, and, furthermore, it must be admitted that we do *disturb* paving more than ordinary traffic, even if we do not wear it; also it is to our interest that we do this work to enable us to maintain our rail in adequate condition. The utmost claim we might fairly make herein is an allowance toward the cost of the work, based on that incurred by the highways authority on the adjoining sides of the road, together with any grant from the Ministry of Transport in respect thereto.

References have been made to the amount paid in local rates in respect of the permanent way, but, so far as I can ascertain the facts, any alteration in the incidence of the charges relating to the repair of the highway would not materially affect the rates payable by the tramways.

The permanent way and overhead equipment are rated in accordance with an early legal decision which laid down that tramway operators had an occupation of the road analogous to that of gas and water undertaking in respect of the pipes laid. In other words, it is the rails laid in the road, and the erection of overhead equipment standards, that bring tramways within the scope of the Rating Acts.

This being the case the repair and renewals of the paving or any portion thereof has no bearing whatever on the liability of tramway undertakings for payment of rates.

Tramways are, or should be, rated on the rent a hypothetical tenant would pay, and the first factor in arriving at this rent is the gross earnings which arise out of the user of the tramway.

The repair and renewal of the tramway is a statutable deduction to be made from the gross estimated rental, and if the liability to repair and renew the paving or any part thereof were taken away from tramway operators, it would appear to follow that the paving would no longer form part of the hereditament for rating purposes, and no such deduction would then arise.

In this event the statutable deductions would be reduced by the elimination of the cost of the repair and renewal of the paving, and the net rateable value on which rates are paid would be correspondingly increased.

One could recite instances of the injustices of our highway liabilities indefinitely. In Manchester we have an instance of a reserve line that practically has had no cars over it—probably not 100 all told—yet has been completely worn out and relaid consequent on the vehicular traffic.

We must not blind ourselves to the fact that the opposition to our proposals will be both extensive and influential.

Our claims therefore appear to be limited to two—

(*a*) The constructional cost of the highway portion so far as it can be shown to represent a cost the highways authority would necessarily incur.

(*b*) A grant toward maintenance of the highway portion based on the ascertained cost of the portions of the same road outside the tramway area inclusive of any Government grant in aid.

The obligation is a statutory one, and only Parliament can modify it. The departmental attitude towards this proposal is, I believe, not at all sympathetic, in which case there would appear to be no alternative but that of a private Bill, and perhaps at this Conference some guidance could be given to our Executive Committee as to what lines they should take to secure a hearing of our case.

DISCUSSION.

Mr. J. B. Hamilton (general manager, Leeds): This is a subject which has been before the Association, in more or less detail, on at least two previous occasions, and I have taken a very close interest in it on each occasion. I think the first gentleman who read a paper was Alderman Fenton, of Sheffield. He was followed by Mr. Chamberlain in a paper which, I think, received inadequate attention owing to it being at the very end of the conference. To that extent I am partly responsible for inciting the secretary—who does not require much pushing, I can tell you—(laughter)—to get someone to prepare a paper, and he fixed up with Mr. Mattinson, who is, as you all know, a specialist in track maintenance and construction, and who has lately been appointed to one of the premier positions in the tramway world. I am sure the very clear statement he has made to-day places the facts before this conference without any necessity on anyone's part to give much discussion upon it. The whole position with regard to road maintenance, as he has clearly pointed out, has entirely shifted from the time when the Tramway Acts were first passed by Parliament, and when the obligation for the maintenance of the whole of the highway within a certain area of each track was put upon tramway promoters. Since then, as he tells you very clearly, we have lost horses as our tractive force, and we do not wear the setts, and if I might add one thing to the paper it would be that we have had the introduction within the past few years of a tremendous amount of fast mechanically propelled vehicles and heavy mechanical haulage, which imposes an additional burden upon us, and, incidentally, furnishes us with an additional reason why we should press for some relief from this improper burden which is placed upon the industry. One hears at a conference like this observations to the effect that the passenger should pay for his ride, and I think that is an argument, with all respect to Mr. Murray and his various schools of thought, that we must all uphold. In doing that, however, I think we are entitled to say what is the cost of the ride; is the tramway passenger to pay for something that ought to be paid for by the general ratepayer? Mr. Mattinson has made some reference to what Sir Henry Maybury has said. Well, we know what Government officials are. They have got to say something sometimes, but it is not likely to have any very great effect, and if you want to get anything done you will have to take other steps. That is why the Executive Council thought they would risk bringing the matter up for the third time to see if we could not take some definite action. I do not think it needs any further argument of additional observations to force the point home. I am responsible for both the track and the tramways in Leeds, the maintenance of the highways, and also the running of the transport, and one would think it would be quite a simple matter to divide those things which ought properly to go to transport from those which should go to highway maintenance, and I see no difficulty in it at all. In fact, I have already settled upon the general lines on which it can be done, but I am then faced with the legal position. Our Town Clerk, who is a stickler for the law, says you cannot shift your burdens off your tramways and put them on to the highways. He says we must pay our proportion, and so you see that although the local authorities themselves would be quite agreeable to doing it, by statute and by law they are forbidden. I think that gives us exactly the line we should go upon, and that is that we must promote a private Bill. I believe that is something that is quite new to this peaceable Association, which might mutter occasionally and complain of injustice, but it has never tried to alter the law itself. If we do suggest that there should be a private Bill, we must carry the municipal Corporations with us. The first thing we must do is to pass an unanimous resolution calling the attention of all municipal bodies to the unfair state of the law at the present time, and asking for remedial measures to be undertaken which will enable the proper charges to be placed against the proper account. I remember the first time we discussed this that the position of those local authorities who had

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companies operating in their areas was raised, and was put forward as a reason why we should not proceed in the matter because there was the certainty that we should get a good deal of opposition from them. I strongly suggest, however, that after the very clear and incisive remarks made by Mr. Mattinson, we should pass some definite form of resolution which will give force to any action of your Executive Committee in taking the necessary steps to get the law, which has become antiquated and unfair, brought up to date, so that the tramway passenger will be charged the proper fare according to the conditions which exist, and for which tramway authorities should be liable. If we did that, I think we should find that the municipal Corporations would support us.

Mr. E. Hatton (general manager, Newcastle): It is just as well that different minds think in different grooves. Mr. Hamilton is perfectly entitled to his views, but I do not agree with him in any shape or form. If these undertakings are going to monopolise your streets and choose the premier position, they must pay their share of the cost of maintaining the roads. I put it to you this way, that if the Manchester Corporation are so terribly sick of their undertaking that they do not want to work it with the present obligations upon it, then I will form a syndicate and lease it from them and pay a rental of £90,000 a year, but Manchester must take their hands off the undertaking altogether. (Laughter.)

Mr. Mattinson: It is not enough. (Renewed laughter.)

Mr. Hatton: We will pay all these onerous charges, and keep the tramway track in repair, and give them cheaper fares than they have to-day, but the Corporation, understand, will have no control over it. It is all very well for Mr. Hamilton to advocate taking the onus off the tramway and putting it on to me as a taxpayer. I wish he would do the same with the income-tax and other taxes, and put them on to Mr. Dalrymple. (Loud laughter.) It is no good advocating that sort of thing and wanting special positions for yourselves; you must pay, and it is only proper that the industry should.

Alderman W. C. Fenton (deputy chairman, Sheffield Tramways Committee): I must say I have been rather astonished to hear the last speech (hear, hear), because I think Mr. Hatton, in the views he has now expressed, shows himself absolutely contrary to everything he said yesterday.

Mr. Hatton: No, no.

Alderman Fenton: That is my opinion, because Mr Hatton is a great advocate of reducing fares, and I think we all are so far as we can, and if the burden were put upon the proper shoulders we should be able to reduce fares at once. I am very glad there has been another opportunity of discussing this matter, because I think, of all items of cost in a tramway concern, the question of road maintenance is the most important, and it is growing in importance year by year. We have heard from Mr. Hamilton and the reader of the paper how they have to bear costs in regard to road maintenance for which they are not responsible at all. At the Sheffield conference I showed samples of rails over which we had not run any cars at all, yet the track had been absolutely worn out, and had to be replaced when we decided to run cars on it. We find in Sheffield, and it is so elsewhere, that where the traffic is heavy we get the greater part of the wear on the rails from heavy motor lorries, and not from our cars at all, and yet we have to pay for it. Mr. Hatton says we ought to pay rates for our privileges, but we do pay rates on our lines, and we shall have to continue to do that, but I do not think we ought to pay for road maintenance when we are not responsible for the wear in any shape or form. I sincerely hope that the Executive Council will take energetic action in this matter, but I am rather afraid we shall have trouble at our own doors, because, after all, the position is this: most Corporations have looked upon their tramway undertakings as milch cows to provide them with money to help them out of difficulties with the rates. You find you have on the Tramways Committees men who are also on the Highways Committees, and they are interested in the opposite direction to the tramway interests, because they fear the Highway Department would be mulcted in a certain amount of the cost of keeping the roads in order which at the present time is borne by the tramway concern. Nevertheless, we ought to bear in mind the fact that tramways, or electric supply, or any other department of a Corporation, ought not to be made to subsidise any other department from the point of view which we are discussing this afternoon. We ought to bear all just claims against us, but we ought not to have to pay for something for which we are not responsible, and which is placed upon us by legislation which is absolutely obsolete and out of date. For these reasons I do not think we can add very much to what has been said in favour of this proposal, but I do think we ought to do everything we possibly can to induce our various authorities to support the Association in promoting a Bill to remedy the defects which are now admitted to be unjust and unfair in their incidence upon the tramway undertakings of the country.

The President: Perhaps the best procedure would be for Mr. Hamilton to move that we take action in the direction he has indicated, and then we will have it seconded and discuss it.

Mr. Hamilton: I will move.

Alderman Fenton: I will second.

Councillor G. R. Davey (chairman, Ilford Tramways Committee): My opinion is that this subject does not deserve discussion. We are all agreed that we are suffering from something which is very terrible. No discussion is necessary; everybody knows that we are paying for something that we have no right to pay for, but you are now suggesting that a movement be made to ask the "powers that be" to give up something that they are now getting for nothing. We in Ilford have built the crown of the road and maintained it for the last 20 years, and carried Foden wagons and trailers behind them, conveying thousands of barrels of beer and tons of iron; it is only within the last few years that the sides of our roads have been paved at all. They used to be macadam, but when mechanical transport became general, did it travel on macadam? Not a bit; it had a nice tramway track to travel on, and it did so. The position created is a terrible one, because I am perfectly certain that our tramway system does not cause one tithe of the wear on the track that we have from these brewers and iron masters. I am not forgetting the omnibuses. I do not say these should be stopped, but on one section of the road in our district we have a three-minute service—three services of omnibuses—and from the fact that land was cheap in our district, they have built garages there, and at times we get a minute service and sometimes a half-minute service of L.G.O.C. omnibuses, all travelling on the centre of the track for which the tramway undertaking has to pay. If we did show a loss of £300 last year, we are not to blame very much. We have made a profit of some thousands this year, but we have got to spend it all on renewing the track for the use of other people. What I am concerned about is, will the authorities look at your suggestion; are they not very careful and economical? They are getting something for nothing, and why should they alter the position? If any steps are taken I think you should deal with the re-drafting of the Tramways Act of 1870, and leave out very carefully anything relating to highways. This is not a recent matter, and last year I was particularly sorry it was not gone into more fully. To-day I can say we are all interested; some of us have suffered in the meantime. You have had balances on the wrong side, and that has bucked you up, and now you are going to try to do something. We look to the Executive of the Association to bring forward something quickly. It must be borne in mind that the authorities are against us from the start, because you are going to attempt to make them pay for something which they have been getting for nothing in the past.

Mr. E. S. Rayner (general manager, Hull): My name has been mentioned in the paper, and I should like to say a few words. My view in connection with road taxation is undoubtedly that every road user should pay his fair proportion for the use he makes of that road. Mr. Hatton has said that the tramways have a monopoly of the centre of the road. That is a particularly dangerous thing, I think, for a manager to say. It has been said before, and was said by Sir Henry Maybury. He said, "Yes, you have a monopoly of the road, and you must pay for it;" but it appears to me that the people who use that argument look at a road and see two lines across it, and imagine that these amount to fences. They do not. We only use so much of the road as is occupied by a tramcar when it is running along that road, and it is a mistake to talk about the monopoly of any road by any tramcar. In connection with another remark that has been made, that the ratepayer should pay for the increased cost of the maintenance of the road, I think that is entirely wrong. I do not think the ratepayer should pay for the increased cost of the maintenance of our roads, but I do think that the road user should pay for the increased cost of our roads, and that cost should be distributed fairly and equitably amongst the road users. I do not think that a lorry having a tare of something like 5 or 6 tons, carrying a load of 7 tons, practically unsprung, should tear through our streets and pay at the end of the year £30 in taxes. That is neither equitable nor fair, and it certainly is not fair that the tramways should pay for 50 per cent. of the road surface. I quite agree that tramways should pay their fair proportion of the cost of maintenance of the roads, and the only trouble, as far as I am concerned, lies in the difficulty in apportioning that cost. Sir Henry Maybury suggested that he would tax tramways on a seating capacity. Now, it appears to me that that is going to produce a very difficult state of affairs, because if we are taxed on the seating capacity it means that so much will be paid by the Road Board, or some other authority, to the local authority towards road maintenance, and then we should have to look towards that authority for the maintenance of our track as a whole. Some of us have a good deal of difference of opinion with our surveyors and other people with regard to our portion of the road and their portion of the road, and I think that such an arrangement would only lead to greater complication and greater difference of opinion as to what state of repair our tramway track was to be maintained in. When making my remarks in reply to the paper by Mr. Chamberlain last year, I spoke on the lines that Mr. Mattinson has done in one of

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his suggestions. He says our claims appear to be limited to two, (a) and (b), and in (b) he says, "A grant towards maintenance of the highway portion based on the ascertained cost of the portions of the same road outside the tramway area, inclusive of any Government grant in aid." Now, it seems to me that this is on the right lines upon which alleviation should be given to the tramways. What it would mean would be this, that we should actually maintain our rails and our foundations, and the surface of the road, but we should obtain from the road authority a rebate in regard to the surface of the road equivalent to the area and corresponding to the amount paid by that authority for the rest of the road, including the Government grant from the taxation of the other vehicles. All the speakers have impressed it upon us very thoroughly that this matter does not need discussion to convince them that we must arrive at some fair method of an equitable distribution of this cost. The milch cow has been referred to, but, gentlemen, the milch cow is dry, and many of the milch cows are having to be artificially fed, and therefore there is nothing to get from them. Everybody, as Mr. Hatton said yesterday, is being asked for penny fares, and I agree that that is where we want to get, although we had differences of opinion yesterday as to whether we were all able to get there, but I maintain that if we pay only our fair proportion of track maintenance, then we can render a cheaper passenger service than any other form of traction in existence, and we shall arrive at penny fares.

Alderman T. Hey (chairman, Halifax Tramways Committee): I rise to support most heartily what has been said by Mr. Hamilton. It may, in most authorities, mean little more than a book-keeping arrangement to transfer to the Highways Committee what properly belongs to them, but if it amounts to no more than that it ought to be done, and so far as the tramways making contributions to the rates is concerned, I suppose our experience in Halifax is very similar to the experience in other towns. Not only do we pay what we are rated upon the track, but also a substantial sum annually towards the reduction of rates. I suppose we must have contributed £50,000 in that item alone. It has been stated by one speaker that no such contribution as that ought to be made, but I suggest that the credit of the Corporation enables you to get money for your municipal expenditure, at a cheaper rate than would otherwise be possible. A Corporation can borrow money at 1 per cent. or 1½ per cent. cheaper than a private company, and therefore I think the treasury of the Corporation is entitled to some consideration on that account. I support Mr. Hamilton's suggestion that each tramway authority should be asked to pass a resolution in support of this, so that any proposal from the Executive Council would go forward with the united support of the whole tramway industry. I suggest that the Executive draft a model resolution, which shall be most pointed and explicit, so that they will not be likely to receive a variety of resolutions, some of which, probably, would not be very well understood. (Laughter.)

Captain L. C. F. Bellamy, M.C. (general manager, St. Helens): There are many members of the Institute of Transport here, and as one of them I am going to say something in defence of the president of that Institute, Sir Henry Maybury. Sir Henry Maybury has distinctly stated that in equity we have a case for relief, and he asked us what we wanted at the meeting to which Mr. Rayner referred. Mr. Fell, I believe, was also present at that meeting. Sir Henry Maybury said that if we want to be relieved of the onus of maintaining the track, we might be relieved of it by being taxed, as Mr. Rayner said, on seating capacity, and thus transfer the upkeep of the tramway road surface to the highway authority. But the thing is, do we want that, or do we not want it? It is a direct invitation from the Director-general of the Roads Department of the Ministry of Transport, and it is something we must look at very seriously. Mr. Hamilton worked it out in a paper recently that for Leeds his figure per car which he paid for road maintenance came to over £300, and if we can get it for about £90 per car per annum I think we ought to accept such an offer as that. I do not think we ought to pour cold water on the suggestion of Sir Henry Maybury; on the contrary, I think it is necessary that the Executive should examine the proposal of Sir Henry Maybury, and see if it is not to our advantage to accept such a proposition from the Ministry.

Mr. J. Beckett (general secretary): I daresay you noticed the reply of Mr. Neal to a question in Parliament recently, and I think you will find that it would be more than a book-keeping entry as the Mayor of Halifax suggested. It means that your tramways are laid on first class roads for the most part in this country, and instead of the cost of these roads you now get 50 per cent. by grant from the road fund, and that is something more than a book-keeping entry.

Alderman Hey: My point is that, even if it is only a book-keeping entry, it should be done.

Mr. Beckett: Supposing you throw the whole of the maintenance of roads, including tramways, into a general fund, then the first class roads would get a 50 per cent. grant and I think you would have gone a long way towards meeting the situation. During the past session I have been at the House of Commons once a week, discussing the problem with various sections of the House. One section takes exception to the proposition on the ground that we have not only municipal tramways but company tramways, and to give them a dip into the road fund would be to enable company tramways, without increasing fares, to increase dividends. That is the political problem which we have confronting us. Apart from that, it seems to me the path is fairly clear. At any rate, we have a fair chance of putting our case before the Government. Mr. Hamilton's resolution is as follows—

"That this Association instructs the Executive Council to take such steps as they think proper, with the object of removing the existing inequitable charge upon tramway undertakings in relation to the cost of road maintenance."

Mr. G. W. Holford (general manager, Salford): It is not quite clear that tramways would get 50 per cent. grant for all first class roads. You would only get it for so much of the portion of the roadway as is outside the tramway limits.

Mr. Beckett: But if the tramways were thrown into a general fund with the other road maintenance charges, you have then one common charge for road maintenance, plus tramways. If, then, out of that fund, you took 50 per cent. for tramways, you are approaching something like an equitable charge.

Mr. H. P. Stokes (general manager, Plymouth): It seems to me that this wants putting very strongly, and there is another aspect of the case which has not been touched upon, but which I have come up against. In connection with the improvements of roads which are being carried out at the present time, very often considerable widenings are being made. Plymouth has many narrow roads, and the tramways have been called upon by the Ministry of Transport, as the result of pressure from the Road Board, to move their tram track from positions already occupied into new positions, on account of the new alignment of the road. We have, as a matter of fact, doubled all the single line which was in existence. I have interviewed the officials of the Road Board, and have taken this line of argument—that if you are going to widen this road from a 24 ft. road to an 80 ft. road, in order to do that you will have to spend so much money and build the road on your own method of construction. If we do not lay a tramway track there you are willing to contribute this money towards improving this road. If I put an additional tramway track down there, will you give me the proportion which you would otherwise have to spend in constructing that road? It is a perfectly logical argument, because we were going to put down a very much heavier foundation than they would have put down. So far as we are concerned, we have arrived diplomatically at a result we wanted. (Laughter.)

The President: There is such a general opinion in favour of the resolution that I imagine it will be carried unanimously. It is now as follows—

"That this Association instructs the Executive Council to take such steps as they think proper with the object of removing the existing inequitable charge upon municipal tramways in relation to the cost of tramway track construction and maintenance."

The resolution was carried, Mr. Hatton (general manager, Newcastle) alone voting against it.

THE REGULATION OF TRAFFIC AT TRAMWAY STOPPING PLACES.

The President: The London County Council has asked your Executive to invite discussion on the subject of the regulation of traffic at tramway stopping places. The London County Council has sent a letter to the secretary, which he will read.

The Secretary: This question is dealt with on page 16 of the report, as follows—

Regulation of Traffic at Stopping Places on Tramway Routes.

This subject has occupied the attention of the Executive Council during the year, and representations have been made to the Government, with the object of securing legislation so as to provide that when a tramcar is standing at a stopping place, indicated by a notice on the side of the street, every driver who intends to pass on the left or near side of such car shall draw up immediately before arriving at such stopping place until the road is clear of passengers entering or leaving such car.

The Minister of Transport has declared that he does not see his way to initiate legislation in the matter.

This subject will be submitted to the annual conference for discussion at the instance of the London County Council.

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The following is the letter, together with an extract from the L.C.C. report on the matter, which I have received.

London County Council, County Hall,
Spring Gardens, S.W.1.
27th July 1922.

SIR,—The Council has given further consideration to the question of the regulation of traffic at tramway stopping places. It will be remembered that this subject was dealt with in correspondence which passed between the Council and the Municipal Tramways Association in October and November last, when it was understood that the Association was making representations to the Minister of Transport on the matter. The proposal that the Council should itself seek legislation to authorise it to make a by-law in London has been under consideration, but in view of the attitude adopted by Parliament in the case of the Bills promoted in the session of 1921 by certain provincial corporations, it would not appear that any useful purpose would be served at the present time by seeking private legislation to deal with the difficulty. In the circumstances, therefore, I am directed to ask that the Municipal Tramways Association will be so good as again to take the question into consideration with a view to pressure being exercised, if possible, for the purpose of inducing the Government to take up the matter.

A copy of a report which has been submitted to the Council on the subject is sent herewith.

I am, Sir, your obedient servant,
(Signed) MONTAGU H. COX
Deputy Clerk of the Council.

THE SECRETARY,
Municipal Tramways Association,
5 and 6, Clements Inn, Strand, W.C.2.

COUNCIL MEETING—18TH JULY, 1922.

EXTRACT FROM REPORT OF THE HIGHWAYS COMMITTEE.

Regulation of Traffic at Tramway Stopping Places.

The question of taking steps to obtain the enactment of a by-law to deal with traffic regulation at tramway stopping places has been under consideration on many occasions, and a full report on the subject was submitted to the Council on 13th December, 1921 (pp. 779-781), when the Council decided to direct the attention of the Ministry of Transport to the serious increase in the number of street accidents directly due to vehicles passing on the near side of tramcars when passengers are entering or alighting from the cars, and to inquire what steps it was proposed to take to safeguard the public from this danger in view of the proved inadequacy of existing powers to deal with the matter.

A letter, dated 13th January, 1922, was subsequently received from the Ministry of Transport, in which it was stated "that the Minister is of opinion that it would not be legally possible for him to approve by-laws or regulations under the provisions of the Tramways Act, 1870, which would meet the case, and that he regrets that he does not at present see his way to introduce into Parliament special legislation to meet the wishes of the Council."

In reporting the receipt of this letter to the Council on 14th February, 1922 (pp. 203-4), we submitted a recommendation to the effect "that the Council regrets the decision of the Minister of Transport not to take any practical steps at the present time for dealing with the regulation of traffic at tramway stopping places, having regard to the serious public danger arising under the present state of affairs." An amendment to refer the recommendation back to us was moved, and subsequently withdrawn, and the Chairman of the Committee, by leave, withdrew the original motion.

We have since given further consideration to the question of the possibility of obtaining Parliamentary authority to enable the Council to make a by-law on the lines above referred to. We understand that in the last session of Parliament some of the provincial corporations, including Manchester, Liverpool, Burnley and Preston, tried to get powers, similar to the powers under the Glasgow Act, 1912, under which the Glasgow Corporation have made a by-law to the following effect—

> "When a tramcar is standing at a tramway stopping place, as such stopping places are indicated by a notice on the side of the street, every driver of a vehicle who intends to pass on the left or near side of such car shall draw up immediately before arriving at such stopping place until the roadway is clear of passengers entering or leaving the car."

The Corporation of Manchester was the only one, however, which proceeded with its application before a Select Committee of the House of Lords, to whom the proposals were referred. The other corporations either withdrew or did not proceed with their proposals. In the case of Manchester, the proposal aroused some hostility and a poll of the citizens on the promotion of clause 62 of the Bill, which dealt with the subject, was taken, which resulted in 13,678 for and 1,160 against. The Lord Chairman's comment on the clause was that a general Act seemed to be the proper solution. The Home Office, the Minister of Transport and the Minister of Health all reported adversely on the proposed clause, and many railway companies, the Manchester Committee of Road Users, and the National Alliance of Road Transport Associations all petitioned against the Bill on this point. Evidence was given before the Select Committee by the chief constable, the assistant chief constable, and the procurator fiscal of police of the City of Glasgow, two members of the Manchester Corporation, the Coroner for the City of Manchester and other witnesses. At the end of the case for the promoters, the chairman suggested that the parties might agree certain clauses which could be put in the Bill, which, without going so far as clause 62, might achieve the same object. He particularly referred to the London County Council by-law as regards slow-moving traffic which was in force in London. The opponents conferred with the Corporation and were disposed to accept the London by-law, but the Corporation stated that, in view of the necessity which they felt for the larger powers in the clause, which had been approved by a poll of the citizens, they could not agree and they left the matter to the Committee, the result being that the Committee decided that they could not agree to the clause and it was accordingly struck out of the Bill.

If the Corporation of Manchester, which is the road authority, tramway authority and the police authority in its area, was unable to obtain these powers, it is extremely unlikely that the Council, as it is neither the road authority nor the police authority, would be successful, especially in view of the attitute which has been taken up by the Minister of Transport and the police in London. The point made by the Minister of Transport, that it was already a statutory offence to drive a motor car in a manner dangerous to the public, has had our consideration. As regards this remedy, we would state that in several cases prosecutions for offences of this nature have been instituted and convictions obtained. On the other hand, there are considerable difficulties in the way of obtaining evidence, except in cases of accidents, and the Motor Car Act provides only for accidents attributable to motor vehicles. More than 25 per cent. of the accidents are attributable to ordinary bicycles and horse-drawn vehicles.

Having regard to all the circumstances, we are of opinion that no purpose would be served at the present time in seeking legislation by private Bill to deal with the regulation of traffic at tramway stopping places. In the meantime we have given instructions for the Municipal Tramways Association to be asked again to take into consideration the question of the promotion of legislation to deal with the regulation of traffic at tramway stopping places.

24th August, 1922.

The Clerk of the London County Council,
County Hall, Westminster.

SIR,—I have to inform you that your letter of the 27th ultimo, relating to the question of the regulation of traffic at tramway stopping places, was considered by the Executive Council of this Association last Friday, when the following resolution was passed, viz.—

> "That the subject be placed on the Programme of the Annual Conference for discussion."

I am, Sir, your obedient servant,
(Signed) J. BECKETT,
General Secretary.

Councillor G. R. Davey (chairman, Ilford Tramways Committee): The necessity for something of this nature being done is very plain, having regard to the heavy traffic that is now on the road. I personally, some weeks ago, saw a tramcar stopping at one of our stopping places which is not superintended by the police—being outside the London area we do not get police protection quite so much as is given inside—and there was a constant stream of vehicles, chars-a-bancs, and motor cars of all descriptions, passing on the left-hand side of the road. I must say this to the credit of the motorist, that when he can he passes on the other side of the tramcar, especially if he is a gentleman, but sometimes chars-a-banc drivers and occupants are neither gentlemen nor ladies, and the consequence is that when one vehicle passes closely on the left-hand side, the whole of the vehicles behind it follow, and for a considerable number of minutes there is simply a stream of vehicles, and no one can leave or enter that car at a stopping place. Had the first car travelled on the off side, all the others would have followed. This is a great detriment to our service, and if the conductor had gone off leaving passengers behind he would probably have been reported, and the manager would have slated him accordingly. Therefore I think some steps should be taken to get the "powers that be" to deal with this matter. There is no trouble when you are governed by the police. At a stopping place the policeman puts up his hand, and all the traffic stops, and you can deal with your passengers, but in unprotected places outside the metropolitan area it is a very important matter to know what should be done, and it is a question that should be taken in hand by the Executive.

Mr. T. B. Goodyer (general manager, Croydon): The Metropolitan Municipal Tramways Council has been giving this matter

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careful and serious attention, and I was instructed to communicate with all the coroners in the London district. I did so, and obtained some very useful information. In nearly every case the coroner expressed the view that it would be very desirable if some regulation of a general character could be drafted requiring traffic to be dealt with in the manner indicated. I hope, having expressed that view, that you will give us your support if you possibly can.

Councillor J. Gordon (Liverpool): Last year a number of municipalities proceeded on the lines indicated, and Manchester, Liverpool, and other towns promoted Bills in which these powers were asked. We were very plainly told, however, that we had no chance of getting this matter through owing to the opposition of the Ministry of Transport, and therefore we withdrew the proposals from our Bills.

Mr. James Dalrymple, C.B.E. (general manager, Glasgow): This by-law has been in operation in Glasgow for about ten years. I suppose we were the first, and I do not know whether any other municipality has got the same by-law.

The General Secretary: There are one or two in Scotland.

traffic was held up when passengers were entering or leaving cars. This test was carried out for three days, and proved so satisfactory that it has converted at least one member of the Police Committee to the fact that it is quite workable. When the Managers' Section met in Scotland, they saw that the by-law was working admirably in the Glasgow streets, which are probably more congested than 90 per cent. of the towns of the country. I personally took a very great interest in it, and I never saw a single motor go through the tramway passengers. I did hear of a party of tramway managers who tried to sneak through, but the policeman told them they ought to have more sense. (Laughter.) I am afraid that if we were to ask for the regulation at all stopping places, especially on country roads, we should not get very far, but I do believe that we could put up a strong case that such a regulation should be in force inside the busy areas.

Mr. A. L. C. Fell (general manager, London County Council Tramways): I have no formal resolution framed, but the general idea of the London County Council was that if we could possibly get general legislation, there might be some hope of getting this

Sir Arthur M. Sutherland, Bart., K.B.E., *Vice-Chairman.* **Alderman Richard Mayne,** *Chairman.* **Ernest Hatton,** *General Manager.*
Newcastle Corporation Tramways.

Mr. Dalrymple: It has been exceedingly beneficial in many respects. I remember when we got the by-law that we had the support and approval of the automobile people, and if you were to go to Glasgow to-day and ask the opinion of the motor drivers, the Automobile Club, or the Automobile Association, you would find every one was entirely in favour of the by-law. We have had very many convictions of reckless drivers going through passengers at stopping places, but now I believe you might be a month in Glasgow and never see a driver of a motor car or of a horse vehicle going through between the car and the kerb when passengers are alighting from or boarding cars.

Mr. J. Barnard (general manager, Bolton): This matter is receiving the attention of the Police committee, and the chairman of the Tramways Committee is a member of that committee. I have had many conversations with him, and he has pointed out to me that perhaps we might get a regulation in the centre of our towns, and more particularly at the busy stopping places, where there are usually big congregations of passengers, and it was on that principle that he instructed our Chief Constable to station police officers at one of our most congested points in the borough, where all other

thing through. If we go to the Government simply as individuals, I do not think they will take any notice of us. If the general consensus of opinion is that there should be some definite law with regard to this matter, then the London County Council hopes that the Association will take it up. Perhaps you would like now simply to refer this matter to the Executive for consideration, to see if it is not possible to take joint action.

This course was unanimously agreed to, and the conference adjourned until Friday Morning.

DINNER BY NEWCASTLE TRANSPORT COMMITTEE.

On Thursday evening, September 14, a dinner was given by the Transport and Electricity Committee of the Newcastle-upon-Tyne Corporation, in the Grand Assembly Rooms, Barras Bridge. The president of the Association, Alderman R. Mayne, was in the chair, and there was a very large attendance, including the Lord Mayor of Newcastle and the Lady Mayoress.

After the loyal toasts,

Sir Arthur M. Sutherland, Bart., K.B.E., J.P., proposed "The Municipal Tramways Association," and recalled the fact that this

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was the 21st conference of the Association. Dealing with the question of fares, he said that the right policy, in order to increase income, was to decrease fares, and he commented upon the small number of people travelling by train to-day compared with the numbers carried before fares were increased, as illustrating this point. In order to reduce fares, it would be necessary to reduce working expenses in every direction, and as to wages, although the tramway men in Newcastle were a splendid, hardworking set of men, he saw no reason why a man, because he was in public service, should be paid a bigger salary than was paid for similar work in other industries. They had to remember that their customers, the business people who rode in the cars, had less income than they had before the war; in fact, everybody's income was suffering from all kinds of taxation, and there was hardly a manufacturer in the country who was not willing to take work at the present moment if he could only get his bare costs out of it. Indeed, many contracts had been made recently which would not cover costs. Some of them had said at the conference that we must not go back to pre-war conditions, but we might be compelled to, because our customers have not the income they had before the war.

Alderman Mayne (the president), replying to the toast, referred to the good work that had been done at the conference, and the need for paying attention to the peculiar conditions of each town in arriving at the best policy to adopt for the tramway undertaking. They must have absolute control over their concerns, and there must be no influences, except those which led to the successful carrying out of the work they had to do. Their first duty was to carry the people, and he was not in agreement with those places which had doubled their fares in order to get more money, but only carried three-quarters of the people they did before.

Mr. Ernest Hatton (general manager, Newcastle), who also replied, suggested that one of the disadvantages of an Association of this kind was that it did too much talking. (Loud laughter.) The world was not run by going from town to town and holding conferences. In the matter of tramway management they must face the facts, which were that it was necessary to reduce working expenses very considerably, not by hunting down the working man, or even tramway managers—(laughter)—but by common sense methods, and the people who were wanted were those who could sell something for a penny which now cost twopence.

Sir John Timpson, K.B.E.
President Municipal Tramways Association, 1922—23.

PRESENTATION TO MR. J. M. McELROY.

At this stage a presentation was made to Mr. J. M. McElroy.

The President: It is my pleasure to-night to have to make a presentation on behalf of the Association to one who has served the Association most loyally, vigorously and usefully. (Hear, hear.) Mr. McElroy is well known in the tramway world, although perhaps not so well known to my colleagues on the City Council, who are all here to-night. I want to tell them that Mr. McElroy for 27 years served Manchester in such a way that the Manchester tramway system is held up as an example all over the country. (Hear, hear.) He served them well and successfully, and at the same time maintained a modest, retiring, but strong and vigorous attitude. Mr. McElroy physically is no longer able to carry on that work, but we as an Association hope that the change—it is not the change which comes to a man in his very old days, when he feels he is done—will give him new life, and opportunities for the exercise of brain power and his capacity for judging and weighing things, and enable him to do work in a sphere the usefulness of which, perhaps, is as great as he has ever experienced, and he will be able to do it in his own time, and in the delightful place where he lives. We all hope it will be the start of a new life for him, and in that new life we wish him happiness. (Applause.) Our gift is not here, but Mr. McElroy has selected a couple of clocks. Manchester has already given him a watch, and it almost seems as if he has got a hobby in that direction. The clocks bear the inscription—"Presented to J. M. McElroy, Esq., by the members of the Municipal Tramways Association Incorporated, as a token of appreciation of his eminent services to the Association and the tramway industry generally."

The President then formally made the presentation to Mr. McElroy, who was toasted with musical honours.

Mr. McElroy (who on rising was received with loud and prolonged applause) said: This is a night of great joy to me, and yet it is tinged with some sorrow. For 20 years I have tried to do my best for the tramway service. You all know Mr. John Young as the pioneer of municipal tramways, and I say this—I have repeated it often—that if Mr. John Young and his brilliant brain had not done so much for tramways in Glasgow I doubt whether there would have been a great number of municipal tramways in existence at this day. He came to me—I was 20 years younger—and said he had conceived the idea of a Municipal Tramways Association, and he said "I want you to be the secretary." I was just in the midst of starting the Manchester tramway system, and it was a pretty big job, but you could not resist anything from Mr. John Young; he made people do what he wanted. He and I talked about it, and then we called in our friend Baker, whom I am glad to see here among us to-night, and the three of us talked it over. Then seven of us talked it over, and we had a first meeting of tramway managers in my office in Piccadilly, Manchester. At this first meeting—tramway managers do not always agree—we could not agree on a broad question of principle. (Laughter.) Mr. Young's idea and my own was that we should have a Municipal Tramways Association, with representatives of the municipal tramways upon it. Some of our colleagues thought it should be a tramway managers' association only, excluding municipal representatives, and they carried the day. We were beaten, and we started as a Municipal Tramway Managers' Association, but within twelve months we had got it all changed, and we had the influence and benefit of the representatives of the municipalities joining up with us. I say that that was a great thing when we did that, because it gave us power, and it gave us influence—(hear, hear)—and that, notwithstanding our friend Mr. Hatton, who just said we are always talking—(laughter)—has done a great deal of good in this country for municipal tramways. If it has done no other good, it has enabled us to deal with Government departments as representing the industry, and that has been a great thing. We have had a good deal of our own way with Government departments. We have moved along from that, and we have had to deal not only with purely technical matters, but matters of policy. We have had to fight Parliament, if I may say so. We have had to go into Parliament on a great many matters, and then we have moved still further than that. During the war the question of wages came along. Our constitution did not allow us to deal with wages questions. We had to deal with wages nationally, because the men, on one occasion when the ball was at their feet, threatened that the men on every tramway undertaking would come out on strike unless we dealt with the whole question of wages nationally. We were driven into that position, and ultimately, in my view, this central settlement has been for the good of the industry. I know that some people do not agree. We set up a Joint Industrial Council, in which I had a hand, and it has done a great deal of good, much more than is generally thought.

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The Municipal Tramways Association at Chollerford.

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I leave the Executive Council with great regret. On that Council there are some very big men. We have our friend Mr. Hamilton, who has done great work in the tramway world. Then there are my friends Baker, Dalrymple, Fearnley, Spencer, and others. It is sad parting with them to-night, but still, as I sit on the pier at Lytham, fishing, I shall sometimes think that these poor chaps are working hard at Westminster, or somewhere else, whilst I am enjoying the breezes from the Atlantic. As I hear these beautiful clocks, which you have so kindly given me, chime the Westminster chimes, I will say "There are my old friends chiming away." I shall think of them, and I shall think of you, and I thank you very much. (Prolonged applause.)

The remaining toasts were "Canny Newcassel," proposed by Sir John Timpson, K.B.E., and responded to by the Lord Mayor of Newcastle; and "The Chairman," proposed by Mr. J. Dalrymple.

There was an informal dance after the dinner, and a very enjoyable evening was spent.

FRIDAY, SEPTEMBER 15.

ANNUAL GENERAL MEETING.

At the annual general meeting, held on September 15, Mr. J. M. McElroy was elected an hon. member of the Association.

Councillor Sir John Timpson, K.B.E. (Mayor of Portsmouth) was unanimously elected president for the ensuing year, and Mr. J. Barnard (general manager, Bolton) vice-president. The hon. officers were re-elected.

There were two vacancies among committee members of the Council, due to the retirement of Alderman Wylie (South Shields), and the death of Alderman E. H. Sellers (Huddersfield). Alderman Craddock (Wolverhampton) and Alderman Wylie (South Shields) were elected to fill these vacancies.

There were four vacancies for managerial members, due to the retirement of Messrs. Mozley (Burnley), Dalrymple (Glasgow) Goodyer (Croydon), and Hatton (Newcastle). The following were elected—Messrs. Priestly (Liverpool), Chamberlain (Oldham), Dalrymple (Glasgow), and Goodyer (Croydon).

On the motion of Mr. J. B. Hamilton, of Leeds, it was agreed to invite the "Union Internationale de Tramways, de Chemins de Fer d'intérêt local et de Transports publics Automobiles" to hold a joint conference with the Association in London.

ANNUAL REPORT OF THE EXECUTIVE COUNCIL.

Membership.

The report of the Executive Council for the year 1921-22, which was adopted at the annual meeting, stated that, after making allowance for new members joined and for decreases caused by death or resignation, the total number of members of the Association was as follows—Local authorities, 95; honorary members, 4; general managers, etc., 96; associate members, 19. The total number of local authorities owning and working tramways in the country was 102.

Allowance for Depreciation.

The negotiations with the Board of Inland Revenue on the question of increasing the rate of annual allowance for depreciation of the value of permanent way had been brought to a close. The result was a revised scheme issued in March last. It was based on the sum actually expended in each case on new or renewed permanent way instead of the arbitrary figure of £4,400 a mile of single track under the first scheme.

Legislation.

The report proceeded to record the steps taken by the Executive which had led to the continuance under the Expiring Laws Continuance Act of the Tramways (Temporary Increase of Charges) Act, 1920. A record was also given of the action of the Executive in connection with the North Western Railways Group Bill, authorising the railway companies to carry on passenger road transport. The Bill was ultimately dropped. In reference to the proposed high value penny, Mr. Harry Allcock, the author of the scheme, had explained his proposal to change the purchasing value of the penny by the adoption of ten pennies as an equivalent of one shilling. On this the Executive passed a resolution expressing the opinion that the adoption of the proposal would be advantageous to tramway authorities.

Rule of the Footpath.

The subject of the rule of the footpath had been under the consideration of the Association for five years. During the past year the Ministry of Transport invited the co-operation of all local authorities in the matter. All the members of the Association were invited to take steps to bring the proposed rule into operation.

Guard Wires Regulations.

In reference to guard wires on electric tramways, the Ministry of Transport in October 1921, issued their revised regulations. Subsequently an interview took place with representatives of the Postmaster-General in relation to the demands made for the cost of guard wires, or, alternatively, the cost of strutting poles in cases where such guard wires were abolished. All the members of the Association had been invited to inform the Executive Council of any demands that might be made on them. The subject continued to occupy the attention of the Council, as it appeared to be a case of the Ministry of Transport assisting the post-office in obtaining protection at the expense of tramway authorities.

Charges for Road Adaptation.

Various proceedings had taken place in connection with the subject of trying to terminate the charges for road adaptation imposed upon municipal motor omnibuses by local Acts. So far no progress had been made. In the opinion of the Executive the continuance of these charges imposed an inequitable burden for a specific purpose in which the municipality shared only in common with every other form of road transport.

Mr. J. Barnard,
Vice-President, Municipal Tramways Association, 1922-23.

Speed Limits.

The Executive had urged on the Ministry that all maximum speed limits for tramcars, except at safety points and on steep gradients, should be abolished, and that the Ministry should prescribe generally that tramcars should not be driven to the danger of the public. The Ministry had replied that they could not see their way to depart from the present practice. It was open, however, to any tramway authority to make application for a revision of the speed fixed.

Unemployment Insurance.

In reference to the State scheme for insurance against unemployment, it appeared that the annual charges for this purpose borne by members of the Association alone amounted to no less than £114,000, and by their employees £102,000; while on the other hand the normal amount of unemployment in this industry was comparatively small. Special schemes for such insurance by industries were permissible, and investigations were now being made into the possibility of establishing a special scheme for the tramways industry.

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STANDARDISATION OF GEAR WHEELS.

A special committee of the Association have been occupied during the year on the proposed standardisation of gear wheels and pinions and gear cases. The Executive Council had invited the British Engineering Standards Association to undertake the preparation of a standard specification for gear wheels and pinions used on tramcars. That Association had expressed their willingness to do so.

PROVISION FOR RENEWALS.

Referring to the subject of provision for renewals in tramway undertakings, the report stated that in most cases the published balance sheets of municipal tramway authorities did not make any provision for renewals not actually effected before arriving at the balance. In general it was one of the conditions imposed by orders issued under the Tramways (Temporary Increase of Charges) Act that reasonable provision for the proper repair, maintenance, and renewal of the undertaking was made. As the result of an analysis of the results of operating various undertakings of members of the Association for the last financial year it appeared that the amount required for renewals at 2d. per car-mile on the car mileage run was £2,298,319. After making allowance for surpluses without provision for depreciation and other deficits, the net aggregate deficits for the year on this basis amounted to £840,772. In reference to tramways and local rates, a statement in regard to a number of tramway undertakings showed that for the year 1922-23 so far as could be ascertained the total amount charged on rates for tramway deficits was £261,222, while the total amount estimated to be contributed from tramway surplus to the rates was £37,465. The rate poundage for tramway losses varied from 1·66d. to 25·79d. in the £1. The figures as to charges on and contributions to rates referred to 27 tramway undertakings.

The Executive recorded their deep sense of loss caused by the death of one of their valued colleagues, the late Alderman Sellers, J.P., of Huddersfield, in whom the Association had a warm-hearted friend for many years. The Executive also regretted that after the annual conference they would be deprived of the active co-operation and services of Mr. J. M. McElroy, who resigned from the general managership of the Manchester City Tramways on June 30, 1922. Since the formation of the Association he had devoted himself with enthusiasm to its business and necessities. His colleagues desired to place on record their high appreciation of their long and pleasant association with him, and their hope that as the shadows lengthened his health might be restored to him.

The report, which is signed by Mr. R. Mayne, president; Sir J. Timpson, vice-president; and Mr. J. Beckett, general secretary, is a voluminous document extending to some 57 large octavo pages, and includes a number of appendices. Of special value is a tabulated statement giving the financial results of operating municipal tramways for the year 1921-22.

FINANCIAL REPORTS AND MEETINGS.

BROWETT, LINDLEY AND COMPANY have announced an interim dividend of 4 per cent. actual, less tax, on the ordinary shares.

DUNDEE, BROUGHTY FERRY AND DISTRICT TRAMWAYS COMPANY.—A dividend has been announced at the rate of 7 per cent., less tax.

RAWTENSTALL CORPORATION TRAMWAYS.—The total revenue for the year ended March 31, 1922, was £67,830, an increase of £2,546 over the previous year, while the working expenses amounted to £49,942, a decrease of £4,627. Capital charges amounted to £13,404, leaving a profit of £4,484. This sum, together with an amount paid in aid from the rates of £1,500, has been carried to the renewals fund. The total income per car-mile was 25·21d., and the working expenses per car-mile 18·56d., the percentage of working expenses to total revenue being 73·63. The number of passengers carried was 6,855,862, compared with 8,097,229 last year.

WEST HAM CORPORATION TRAMWAYS.—In his report for the year ended March 31, 1922, Mr. M. L. Slattery, general manager, says that the total traffic revenue, including through running adjustments, amounted to £306,488, which was £1,803 more than in the previous year, thus creating a further record. The working expenses were £275,451, a decrease of £23,069. The gross profit, after meeting all charges other than capital and excluding net rentals received, amounted to £32,337, equivalent to 5·74 per cent. on the capital of the undertaking. The net result, exclusive of reconstruction of track and war allowance, shows a surplus of £1,957, and compares with a deficiency of £22,506 in the previous year. After making allowance for interest and sinking fund contributions, reconstruction of track (£58,642), etc., a contribution from the borough rate was required of £57,301. The tramways department paid to other departments of the Corporation for the year a total of £79,187, which is equivalent to a 15d. rate. The average earnings per car-mile were 22·15d., as against 21·48d. for the previous year. The report contains full particulars of the reconstruction of the track, its maintenance, overhead equipment, and reconstruction of rolling stock, which have been carried out by the tramways department, including a brief description of a new double-deck car.

ABERDEEN CORPORATION TRAMWAYS.—As briefly mentioned in our issue of September 14, these tramways for the year ended May 31, 1922, showed a gross profit of £46,639. This was £12,754 more than in the previous year, and after setting aside £31,550 for interest and sinking fund, depreciation, etc., there is a net profit of £15,089. This is the largest net profit ever earned by the undertaking, and, in accordance with the Corporation Confirmation Act, 1915, one-third of this sum is paid over to the common good and city improvements. The remaining £10,059 has been placed to the reserve fund. The revenue from the system shows a decrease compared with the previous year owing to the falling off in the number of passengers carried, mainly due to the prevailing unemployment. A large number of workshops were on short time, while others, particularly the shipyard works, were practically closed. The revenue from the motor omnibuses, however, shows an increase, so that the combined receipts of the tramways and motor omnibuses amounted to £196,268, and constitutes a record for the undertaking. The working expenses were £137,978. The working of the motor omnibuses was very successful. The receipts amounted to £11,650 and the working expenses to £8,443, leaving a gross profit of £3,207. After deducting interest and sinking fund, a net profit of £770 was shown, which has been carried to the depreciation and renewal account. During the year £7,890 was expended on capital account on the construction of new cars and permanent way, making the total capital expenditure £425,708. The number of passengers carried aggregated 41,087,388, a decrease of 4·35 per cent. The car mileage run was 2,225,889, a decrease of 2·36 per cent. The parcels traffic, the receipts from which were £1,262, showed a slight decrease, but there was a profit of £627. The insurance fund, which on June 1, 1921, stood at £6,543, has, owing to claims paid, been diminished to £6,261. The current consumption per car-mile was 1·331 units, or slightly more than in the previous year. The average total revenue per car-mile was 19·67d., and the average working expenses per car-mile 14·70d. The department now has 99 tramway cars, 7 motor omnibuses, and 2 motor coaches, and the employees number 476.

NOTTINGHAM CORPORATION TRAMWAYS.—The annual report of the committee for the year ended March 31, 1922, revealed a loss of £372; but the chairman, Mr. J. Clarkson, pointed out that the loss was really about £20,000, nothing having been placed to the reserve fund this year, or last year. This loss was incurred by reason of the serious curtailment of the services during the coal strike period (on account of the consequent shortage of coal), which extended over thirteen weeks of the best traffic period of the year, together with the subsequent depression in trade. In effect the public had been travelling under cost price. The reserve fund had gone down from £118,111 in 1919 to £50,092, and Mr. Clarkson urged that if they had a normal year this year, as anticipated, the committee's first duty would be to build up the reserve fund to a proper amount. It had been found that the motormen were using rather an excessive amount of current, but he was glad to say that great progress and great economies were being effected amicably. The accidents reserve fund now stands at £10,523. The traffic receipts of the tramway services amounted to £352,032, and sundry receipts £2,933, making a total of £354,965, a decrease of £43,948 compared with the previous year; working expenses amounted to £286,856, a decrease of £50,771, leaving a gross profit on working of £68,109. The total receipts from the motor omnibus services were £6,914, the amount being considerably increased on account of the abnormally heavy traffic carried during the periods when the tramway services were suspended consequent upon the coal shortage, the omnibuses being diverted to the busiest sections of the tramway routes. The operating expenses amounted to £6,249, leaving a balance of £665 to meet interest, sinking fund, and depreciation charges. The available balance of £68,774 was appropriated as follows—Interest on capital, etc., £22,990; redemption of debt, £25,254; income-tax, £20,902; leaving a deficit on the year's working of £372, which has been met out of the reserve and renewals fund. The total number of passengers carried on all the services aggregated 55,382,555, a decrease of 6,783,818 compared with last year. This figure does not, however, include any journeys made by the 244 blind persons and 357 disabled ex-service men who possess passes enabling them to travel free of charge on the tramway cars and omnibuses. The cars and omnibuses ran a total of 4,006,373 miles, or a decrease of 315,080. Total receipts per mile run averaged 21·67d., compared with 22·38d.; working expenses averaged 17·56d., against 19·05d.; whilst the average fare paid per passenger was 1·55d. The Corporation now possess 180 cars and 9 motor omnibuses.

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TRAMWAY AND LIGHT RAILWAY NOTES.

BIRMINGHAM.

TRAMWAY JUBILEE FARES.

The Corporation will soon be in a position to celebrate a tramway jubilee. The service was opened by private enterprise in 1873, and in 1907 the Corporation took it over from the City of Birmingham Tramways Company, Limited, and introduced the electric tramway system. The Corporation now owns 127 miles of track. It has been decided to reduce long-distance fares by a halfpenny, and to give special privileges for workmen. An ordinary 6d. return fare will now cost them 4d. No alteration is made in the 1d. and 1½d. fares. The former were reintroduced in February, and have occasioned a loss of from £700 to £800 weekly, although more passengers are carried.

BRADFORD.

TWOPENNY FARE.

Mr. R. H. Wilkinson, general manager of the Corporation Tramways, predicts that there will be a reduction in revenue of £86,860 if penny fares are reintroduced. In regard to the present minimum charge of 2d., he has reported that not less than 56 per cent. of the total income is derived from this fare, and that the running costs work out at 1·508d. for the first mile. As 2d. is the nearest and most convenient fare to adopt, it should be allowed to remain until costs are reduced and deferred liabilities for renewals made good. At a committee meeting, the chairman, Alderman E. Priestley, described the twopenny fare as the sheet-anchor of the department, and pointed to the difficulties which many municipalities were at present experiencing through their adoption of a cheaper fare. There was, he said, agreement between local tramway employees and the authority that the system must be self-supporting.

DOVER.

TRACKLESS CARS.

The Town Council have decided not to promote a bill for power to provide trackless cars, owing to the cost not having been included in the estimates.

DUDLEY.

POST-OFFICE AND POLES.

The Town Council have received a letter from the Post-Office stating that the removal of certain tramway poles and their erection in close proximity to the telegraph route would interfere with the development of this route, and requesting the Council to admit liability to bear the cost of the alterations to the telegraphs which have been rendered necessary. The Council repudiated liability, and referred the Post-Office to the tramway company, who carried out the work of removing the tramway poles.

DUNDEE.

EMPLOYEES' CONDITIONS—TROLLEY GUARD.

The Town Council have decided that all tramway employees shall be guaranteed a working week of 48 hours, and that a man can be employed up to 52 hours before overtime is commenced. The Tramways Committee are interesting themselves in a new safety device for the prevention of trolley heads falling off. It is stated that the new apparatus, which was put to several tests, and proved very effective, is very simple in design, and the cost is comparatively trifling. It is proposed to have it installed on all the cars.

EDINBURGH.

EXTENSION—SUNDAY PAY.

It is proposed to extend the tramway system to Corstorphine, and to purchase 30 additional electric cars in view of the whole of the tramway system being under electrification by next year. The suggestion has been made that, with a view to saving the time of the conductors, notices should be placed on the cars asking passengers to tender the exact fare. After hearing a deputation of tramway employees who urged that time and a half rates should be continued for Sunday duty, instead of the proposed time and a quarter, the Town Council again referred the question to the Tramways Committee.

GLASGOW.

PROPOSED EXTENSION—PAISLEY'S COMPENSATION—EMPLOYEES' WAGES.

The Corporation have decided to apply for a Provisional Order including powers to acquire and manage the Glasgow District Subway and the Paisley District Tramways, and to extend the tramway system by six new routes. It has been decided to pay £18,000 to Paisley Corporation as compensation for plant to be thrown out of use and loss of revenue in respect of Paisley's municipal supply of electricity to the tramways company, whose undertaking is being taken over by the Glasgow Corporation. A revision of the wages of employees of the Corporation is being undertaken by the Corporation Conditions of Service Committee. In the case of motormen and conductors employed by the tramways department the committee propose to reduce the wages from 69s. to 63s. per week, by three instalments of 2s. each, the reductions to take effect on the first full pay days in October, November, and December. This arrangement will continue until the end of December, when a further revision will be undertaken.

HULL.

PENNY FARES—TWO ESTIMATES.

The Tramways Committee have decided to reintroduce penny stages. It was felt that the reduction in the wages of the workers using the cars warranted cheaper fares, and owing to economies it was anticipated that the loss would be negligible. A tender of £8,000 from a private contractor has been accepted for the renewal of a portion of the tramway track. The estimate of the City Engineer, whose department had already carried out considerable renewals, was £16,000.

LONDON.

PROTECTION OF PASSENGERS—SAFETY AT CROSSINGS.

The number of accidents to passengers alighting from or getting on to tramway cars continues to increase. The London County Council is willing to take up any case of a vehicle being driven to the danger of tramway passengers, if the passengers will furnish the conductor with their names and addresses. Convictions for this offence have been secured by the Council, and penalties of £10 and costs have been inflicted. With a view to the greater safety of persons crossing the road in the tramway-lined main roadways a suggestion of Dr. F. J. Waldo, J.P., who has recently completed 21 years' service as coroner for the City of London and Southwark, has been adopted by the Southwark Borough Council. Signboards with the words "Cross the road here" have been fixed to lamp-posts at crossing places on each side of the road. A constable on fixed point duty holds up the traffic and then guides people across.

MANCHESTER.

TRAFFIC CONGESTION.

Representatives of the Improvements, Tramways, and Watch Committees of the Manchester Corporation have discussed the question of street traffic congestion. A suggestion was made that the tramways should be removed from the centre of the city, but the Tramways Committee, it is understood, opposed this, believing that there was another solution of the problem. The conference was adjourned for a fortnight, the City Surveyor being requested to prepare plans of the first and second class streets in the centre of the city, with a view to showing what is the possibility of widening and improving them.

NEWCASTLE-ON-TYNE.

INDUSTRIAL COUNCIL.

The Corporation has withdrawn from the Industrial Council for the tramway industry.

SHEFFIELD.

HOURS OF WORK—A SAVING.

The Corporation tramway employees have been expressing dissatisfaction with the allocation of time worked. They contend that they have been getting only a short day's wages for long periods of work, and they have asked for a return to the 48 hours' week. The Tramways and Motors Committee will, it is estimated, be saved nearly £4,000 per annum by recent wage reductions in the engineering trade.

SOUTH SHIELDS.

WORK FOR UNEMPLOYED.

With a view to providing work for the unemployed, the Tramways Committee have decided to recommend that a scheme for the extension of the tramways shall be submitted to the Unemployment Grants Committee.

SOUTHPORT.

TRAMWAYS V. MOTOR OMNIBUSES.

Alderman T. S. Richardson, chairman of the Tramways Committee, stated recently that there was no town that was displacing tramway cars by motor omnibuses. The present type of omnibus did not, could not, and would not compete with the tramway car for passenger carrying. They would want double the number of omnibuses to carry the passengers they were carrying on the cars, and the operating cost of an omnibus had been proved to be more than that of a tramway car.

SUNDERLAND.

JOINT COUNCIL—WAGES.

The Town Council have decided to withdraw from the Joint Council for the tramways industry. The employees have expressed a wish that the decision shall be reconsidered. A reduced scale of wages has been prepared by the Tramways Committee, who, pending negotiations with the men's representatives on the scale, will adopt temporarily any terms agreed by the Joint Council. The new scale is conditional on the men agreeing to a reduction in the annual holiday with pay from eight to six days. Under it no man at present on the traffic staff will receive less than 51s. a week, and new men will not receive less than 50s. Comparisons of present wages with those proposed under the new scale include—Motor inspectors, 78s. 3d.—65s.; ticket inspectors, 73s. 6d.—61s.; motormen, 68s. 6d.—57s.; conductors, 62s. 9d.—53s.

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PERSONAL.

Mr. Bertram G. Kelly, A.M.I.E.E., has been appointed first electrical engineer of Douglas Town Council.

Mr. A. T. Rodwell has been appointed electrical engineering assistant to the Johannesburg Municipality.

Mr. A. F. Berry, of the British Electrical Transformer Company, has joined the directorate of the Edison Swan Company.

Mr. A. G. Beard has been appointed shift engineer at the power-station by the Swindon Electricity and Tramways Committee.

Mr. Douglas H. Bishop, B.Sc., has been appointed electrical engineer to the Dundee Corporation at a salary of £800, rising to £1,000 per annum.

Mr. William Henry Brown, J.P., has just completed fifty years' service with the Metropolitan Railway Company, of which he has been secretary since 1908.

Mr. James Hutchison, president of the West India Electric Company, which owns the electric tramways in Jamaica, has been visiting London in connection with plans for the extension of the company's undertaking.

Mr. Charles Challenger, a director of the Bristol Tramways Company, celebrated the seventieth anniversary of his birthday on September 19. He has been for 40 years, 1879 to 1919, engaged in the management of tramways, having joined the Bristol Company as traffic manager in 1882, after holding managerial appointments at Neath and Gloucester.

Mr. Walter T. Young, tramways manager of Dundee Corporation, has been granted an increase in salary from £600 to £700 per annum. Lord Provost Spence, in moving the approval of the recommendation of the Tramways Committee, said that Mr. Young, when he came to Dundee, had given up a higher salary. He had received no increase since his appointment, and the addition would give him the salary which some of the Council thought he should have had when he accepted the post.

CONTRACTS AND ORDERS.

Ipswich Corporation have ordered several railless cars from Railless, Limited.

East Ham Tramways Committee have authorised the purchase of a motor car.

Norwich Corporation have decided to purchase two more electric vehicles for refuse collection.

Railless, Limited, have received an order for four railless cars from West Hartlepool Corporation.

The Metropolitan-Vickers Electrical Company, Limited, are to supply a switchboard to Burton-on-Trent Corporation.

Hackney Works Committee are to purchase 20 electric vehicles for house refuse collection from Richard Garrett and Sons, Leiston, at £750 each.

Sydney (N.S.W.) Municipal Council are considering the recommendation of their electricity committee to purchase a 6-ton lorry for haulage work.

Swindon Electricity Committee have accepted the Western Electric Company's tender for 2,300 yards of H.T. cable and 600 yards of L.T. cable at £628.

Bridlington Corporation propose to purchase a small motor vehicle for the electricity department, so that men and tools can be speedily despatched to deal with breakdowns.

Bradford Tramways Committee have accepted the tender of Mr. W. H. Booth, of Rotherham, for 20 tons Peckham hand-brake shoes at £190, and 20 tons track-brake blocks at £200.

The Indian Government have sanctioned the electrification of a large portion of the Bombay suburban lines of the Great Indian Peninsula Railway, and tenders for the necessary plant will be invited at an early date. The total expenditure will probably reach £2,000,000.

The British Thomson-Houston Company, Limited, of Rugby, are the successful tenderers for the 3,000 KW. generator required for the power-station at Newton Abbot of the Taunton Town Council. The price for the nine-stage turbine, including a stand-by extraction pump, is £17,330. Nineteen tenders were received.

The English Electric Company, Limited, have been successful in obtaining a further contract, amounting to £94,900, from the Preston Corporation for the erection of the new super-generating station, to be known as the Ribble power-station. It may be recalled that the English Electric Company are also supplying the large turbo-generator sets, condensers, etc., for the station.

Salford Tramways Committee have recommended the acceptance of the following tenders—Hadfields, Limited, points and crossings; Enfield Ediswan Cable Company, lead-covered cable, £361 10s.; W. T. Glover and Company, 1,350 yards lead-covered cable, £1,073 5s.

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PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given in italics.

Applications for Letters Patent.

The number of the patent is given in brackets.

Steering gear for mechanically propelled vehicles (24,427)—R. Bishop, H. W. Egerton and Marles Steering Company, Limited.
Motor vehicle bodies (24,197)—Charlesworth Bodies, Limited, O. J. Critchard, S. B. Jackson, and C. Steane.
Motor vehicles (24,465)—W. A. Cocking and W. E. Hean.
Balance gearing for motor vehicles (23,988)—J. MacDougall.
Steering mechanism for motor vehicles (24,891)—A. O. Berry and N. N. Shreiber.
Driving mechanism for power-propelled vehicles (24,892)—A. O. Berry and N. N. Shreiber.
Spring suspension of motor vehicles (24,893)—A. O. Berry and N. N. Shreiber.
Mechanism for operating brakes of motor vehicles (25,135)—T. J. Conley.
Change-speed mechanism for motor vehicles (25,034)—A. V. Halsall.
Safety device for street car trolley poles, etc. (24,769)—J. King.
Electrically operated vehicles (24,589)—Metropolitan-Vickers Electrical Company, Limited.
Track signals for tramways (24,839)—J. V. Payne.
Car journal bearing and lubricating means therefor (24,918)—F. Radcliffe.
Bodies of motor vehicles (25,393)—Sir H. Austin.
Bodies of motor vehicles (25,338)—Barker and Company (Coachbuilders), Limited, and C. F. Dingwall.
Brakes for motor vehicles (25,469)—F. H. Boyce and Rolls-Royce, Limited.
Tramway and electric railway rails (25,288)—E. W. Hodgson, W. Smith, and J. Wolstenholme.
Apparatus for indicating number of vacant seats on tramcars, etc. (25,269)—R. McGown.
Life-guards for motor vehicles (25,242)—J. G. Navarro.
Anti-skidding devices or brakes for road vehicles (25,511)—H. L. Scowcroft.

Specifications Published

1921

Power transmission appliances for motor vehicles (21,236—*184,372*)—F. W. Golby (*United States Pulley Manufacturing Company*).
Means for lubricating the armature and axle bearings of tramcars, etc. (13,819—*184,576*)—H. Murgatroyd.
Motor road vehicles (14,418—*184,598*)—A. J. Clifford, C. J. Clarke, E. Bailey, and A. F. Clarke.
Suspension device for overhead conductor wires for electric railways, etc. (15,940—*184,629*)—Sir P. Dawson and F. W Fawdry.
Control of electrically propelled vehicles (17,255—*184,646*)—M. J. Pattison and Electro-Mechanical Brake Company, Limited.
Foot brakes for motor vehicles (20,037—*184,679*)—Daimler Company, Limited, and G. H. Henson.
Frames for motor vehicles (20,039—*184,680*)—Daimler Company, Limited, and H. C. Inskeep.
Steering and driving of motor vehicles (20,073—*184,681*)—P. M. Wilson.
Lifting jacks (26,691—*184,723*)—A. E. Lake.
Sheet metal sleepers for tramways and railways (34,794—*184,743*)—A. H. Hill and E. Roberts.
Fare systems and means used therewith (8,861—*184,830*)—G. B. Ellis (*Johnson Fare Box Company*).
Internal combustion engines for motor vehicles (13,903—*163,331*)—Argus Motoren-Ges.
Change-speed gear operating mechanism for motor vehicles (19,221—*184,974*)—Armstrong Siddeley Motors, Limited, and F. R. Smith.
Trucks for tramway vehicles (21,644—*185,009*)—S. Thomas and Peckham Truck and Engineering Company, Limited.
Change-speed gearing for motor road vehicles (22,554—*185,017*)—J. Rhodes.
Sockets or bases for trolley poles for electrically propelled vehicles (24,782—*185,031*)—E. M. Munro.
Method of attaching or fastening pieces of old tramway rails to act as anchors to existing or new tramway rails (20,720—*185,306*)—H. W. A. Brown.

1922

Devices for preventing the creeping of rails on tracks (822—*185,061*)—L. P. Winby.
Grooved compound tramway rails (2,087—*175,259*)—F. Krupp Akt.-Ges.

Standard Brushes.—The British Engineering Standards Association have issued a specification (B.S.S. No. 96-1922) dealing with parallel-sided carbon brushes for d.c. commutator machines. The specification may be obtained from the Secretary, British Engineering Standards Association, 28, Victoria Street, London, S.W.1. (price 1s. net, post free, 1s. 2d.).

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1921. WEEKS ENDED Sept. 10	Sept. 17	Sept. 24			1922. WEEKS ENDED Sept. 9	Sept. 16	Sept. 23			AGGREGATE. Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	4,258	3,585	3,552	...	...	4,069	3,666	3,447	...	...	16¾	63,047	+ 616
Aberdeen Motor Buses	249	228	212	...	...	337	239	174	...	...	16¾	5,436	− 671
Ayr Corporation	855	1,527	749	...	...	724	778	1,560	...	...	19	17,596	− 806
Barrow Corporation	998	835	810	...	...	657	578	559	...	...	25	15,922	− 7,050
Belfast City Tramways	13,081	12,515	12,474	...	...	12,676	12,770	12,395	...	...	25	296,337	− 21,640
Birkenhead Corporation	2,922	2,869	2,835	...	...	2,428	2,393	2,409	...	...	25¾	62,128	− 3,911
Birkenhead Motor 'Buses	742	662	645	...	...	841	821	764	...	...	25¾	20,643	+ 1,138
Birmingham Corporation	29,418	29,167	29,142	...	...	28,073	28,311	28,397	...	...	25	709,756	− 28,659
Birmingham Motor 'Buses	2,151	1,893	1,947	...	...	1,915	1,849	1,830	...	...	25	47,067	− 6,885
Blackburn Corporation	2,769	2,696	3,109	...	...	2,759	2,603	2,593	...	...	25¼	63,749	+ 3,430
Bradford Corporation	14,485	13,495	14,876	...	...	14,073	14,217	13,838	...	...	25	357,381	+ 13,412
Brighton Corporation	3,252	2,849	2,810	...	...	2,954	2,703	2,541	...	...	25¾	68,709	− 877
Burnley Corporation	3,902	3,463	3,658	...	...	3,613	3,602	3,441	...	...	—	—	—
Burton-on-Trent Corporation ..	676	636	660	...	...	559	552	564	...	...	24	14,361	− 1,693
Bury Corporation	2,863	2,567	2,783	...	...	2,862	2,452	2,710	...	...	25¾	64,115	+ 399
Chatham and District	1,862	1,765	1,745	...	...	1,839	1,701	1,689	...	...	38	63,598	− 56
Chesterfield Corporation	1,407	1,396	1,413	...	...	1,247	1,220	1,258	...	...	24	30,570	− 3,593
Derby Corporation	2,305	2,175	2,224	...	...	2,321	2,186	2,198	...	...	25	55,156	− 15
Dundee City	3,325	3,281	3,197	...	...	3,296	3,057	3,032	...	...	18¾	56,415	− 5,357
East Ham Corporation	2,169	2,176	2,149	...	...	1,996	2,063	2,086	...	...	25¼	53,781	+ 296
Edinburgh Corporation	12,973	11,733	13,269	...	...	12,206	11,748	12,132	...	...	19	256,733	− 17,527
Edinburgh Motor 'Buses	3,606	3,104	3,722	...	...	3,015	2,792	2,941	...	...	19	69,204	− 4,826
Glasgow Corporation	47,708	45,809	46,741	...	...	43,912	43,629	43,323	...	...	16¼	690,340	− 55,223
Glossop (Urban Elec. Supply Co.)...	261	253	267	...	...	227	246	232	...	...	38	8,593	− 270
Halifax Corporation	4,952	4,819	4,478	...	...	4,636	4,560	4,217	...	...	24¼	109,946	+ 17
Halifax Motor 'Buses	52	54	52	...	...	103	100	102	...	...	24¼	2,089	− 127
Halifax Railless Cars	68	63	61	...	...	34	38	29	...	...	24¼	1,141	+ 551
Huddersfield Corporation	6,196	5,139	5,205	...	...	5,866	5,336	5,422	...	...	26	141,877	− 2,731
Ilford U.D. Council	1,523	1,487	1,567	...	...	1,417	1,367	1,403	...	...	25¼	37,083	− 1,824
Ipswich Corporation	1,040	937	956	...	...	920	849	862	...	...	25	22,213	− 615
Isle of Thanet...	3,038	2,650	2,094	...	...	2,915	2,377	1,833	...	...	50¼	59,665	− 2,445
Kilmarnock Corporation	379	367	374	...	...	328	320	332	...	...	18¾	6,193	− 890
Leicester Corporation	7,281	7,113	7,584	...	...	7,291	7,286	7,453	...	...	38	278,986	+ 36,065
Liverpool Corporation	31,584	30,039	30,416	...	...	29,997	29,873	29,729	...	...	38	1,118,805	+ 21,968
London County Council	102,158	100,682	99,525	...	...	94,418	92,449	93,091	...	...	24¼	2,321,191	− 204,448
Maidstone Corporation	544	561	515	...	...	509	512	521	...	...	24¾	12,565	+ 5
Manchester Corporation	39,756	37,930	39,092	...	...	36,126	35,008	35,260	...	...	25	894,610	− 98,811
Newcastle-on-Tyne Corporation ...	10,190	11,458	11,546	...	...	11,700	9,940	10,231	...	...	25	258,631	− 30,118
Nottingham Corporation	7,538	7,294	7,295	...	...	7,795	7,714	7,695	...	...	25	193,659	+ 36,122
Oldham Corporation	4,959	4,912	5,011	...	...	4,680	4,536	4,679	...	...	26	121,618	− 6,725
Portsmouth Corporation	6,697	5,581	5,516	...	...	5,837	5,257	4,988	...	...	25	135,734	− 8,535
Preston Corporation	2,118	1,955	1,906	...	...	3,705	3,592	1,831	...	...	24¾	49,196	+ 903
Preston Motor 'Buses	...	...	...	...	...	228	203	138	...	...	24¾	3,442	—
Reading Corporation	1,681	1,696	1,600	...	...	1,590	1,520	1,508	...	...	25	39,166	− 1,031
Reading Motor 'Buses	399	359	347	...	...	395	378	383	...	...	25	9,305	+ 156
Rotherham Corporation	2,477	2,498	2,340	...	...	2,077	2,039	2,118	...	...	24	51,085	− 2,442
St. Helens Corporation	1,879	1,844	1,728	...	...	1,730	1,712	1,601	...	...	25	39,725	− 6,341
Salford Corporation	11,222	2,887	10,819	...	...	10,803	9,538	9,791	...	...	25¾	256,897	− 17,660
Sheffield Corporation...	20,196	19,363	20,164	...	...	17,952	17,539	18,065	...	...	25¾	460,140	− 39,142
Southampton Corporation	3,484	3,374	3,281	...	...	3,451	3,252	3,244	...	...	25	80,744	+ 6,655
Southampton Motor 'Buses	98	99	97	...	...	108	174	182	...	...	25	2,680	− 2,249
Southend Corporation	3,917	3,511	...	...	...	3,693	3,295	...	...	...	24	72,737	+ 3,686
South Shields Corporation	1,868	1,761	...	...	...	1,629	1,604	...	...	...	24	41,674	+ 788
Sunderland Corporation	3,003	2,660	2,787	...	...	2,462	2,512	2,379	...	...	25	65,630	− 2,388
Swindon Corporation	446	421	424	...	...	386	364	362	...	...	24¾	9,116	− 1,212
Tyneside Tramways and Tramroads	1,211	1,165	1,127	...	...	867	849	824	...	...	12	10,653	− 3,422
Wallasey Corporation	3,192	2,795	2,815	...	...	2,862	2,674	2,591	...	...	25¼	68,731	− 5,202
Wallasey Motor 'Buses	320	176	252	...	...	299	224	258	...	...	25¼	6,555	− 115
Walsall Corporation	1,678	1,641	1,594	...	...	1,415	1,430	1,414	...	...	25	38,396	− 4,006
Walsall Motor 'Buses	1,001	957	916	...	...	740	727	724	...	...	25	20,554	− 3,832
Walthamstow U.D. Council	2,232	1,952	1,982	...	...	1,913	1,833	1,829	...	...	25¼	49,231	− 7,068
Warrington Corporation	1,025	1,011	1,002	...	...	979	976	1,041	...	...	25	23,975	− 538
West Ham Corporation	6,005	6,083	5,881	...	...	5,552	5,590	5,614	...	...	24¾	142,656	− 5,712
Wolverhampton Corporation ...	2,461	2,431	2,372	...	...	2,092	2,029	2,013	...	...	25	52,830	− 5,903
Wolverhampton Motor 'Buses ...	671	706	644	...	...	657	637	621	...	...	25	16,207	− 247

Underground Electric Railways Company of London, Limited.

NAME OF COMPANY.	1921. WEEKS ENDED Sept. 10	Sept. 17	Sept. 24			1922. WEEKS ENDED Sept. 9	Sept. 16	Sept. 23			AGGREGATE. Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Underground Rlys. & L.G.O. Co. ...	245,247	231,669	240,966	...	...	239,428	231,761	234,555	...	...	39	8,623,221	− 403,800
London and Suburban Traction ...	60,598	54,132	56,169	...	...	47,850	44,676	45,028	...	...	39	1,850,586	− 257,712

Colonial and Foreign Tramway Traffic Returns.

Companies Issuing Weekly Returns.

NAME OF COMPANY.		1921. WEEKS ENDED Sept. 10	Sept. 17	Sept. 24			1922. WEEKS ENDED Sept. 9	Sept. 16	Sept. 23			AGGREGATE. Wks.	1922.	Increase or Decrease.
		£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine		84,811	81,017	81,084	...	...	90,407	86,247	88,317	...	...	38	3,177,722	+ 158,996
Calcutta	Rs.	60,680	91,869	97,679	...	...	118,250	123,377	124,762	...	...	38	4,064,166	+1127,076
Madras...	Rs.	(2 weeks)	50,965	...	...	...	(2 weeks)	52,402	...	...	...	37	838,524	+ 149,263
Pernambuco	$	3,810	3,747	3,931	...	...	4,552	4,182	4,062	...	...	38¼	137,537	− 10,500

Companies issuing Monthly Statements only.

		1921. April	May	June	July	Aug.	Sept.	1922. April	May	June	July	Aug.	Sept.	Wks.	AGGREGATE. 1922.	+ or −
		£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo		5,121	4,570	4,135	3,842	...	...	5,473	3,329	4,212	3,770	...	...	16	16,784	− 884
Brazilian Trac. Mlrs		135 62000	144 62000	142 57000	154 77000	157 44000	...	154 13000	160 93000	162 66000	166 55000	171 68000	...	34	126 338000	+14,918000
Brisbane		47,750	...	...	48,850	...	...	48,700	...	...	49,470	...	...	30	341,700	+ 14,555
British Columbia	$	835,793	826,039	803,903	840,155	844,154	...	818,177	827,701	802,511	834,772	842,274	...	8	1,677,046	− 7,263
Buenos Ayres L'c'z		60,238	58,492	51,071	51,944	55,873	...	57,619	59,278	52,642	57,227	55,873	...	8	113,100	+ 5,283
Burma ...	Rs.	50,159	48,353	54,275	43,764	55,168	...	58,631	65,357	61,823	61,637	57,864	...	4	57,864	+ 2,696
Cape Town ...		27,662	27,407	25,038	25,571	25,164	...	28,657	28,006	24,638	26,046	24,970	...	—	—	—
Carthagena & H. ...		2,329	1,602	1,410	1,936	1,773	4,244	2,991	2,793	1,174	2,257	1,880	1,721	39	589,485	− 39,340
Cordoba		...	...	23,129	23,616	23,841	...	...	...	26,622	27,118	27,926	...	21	132,661	+ 16,462
East India ...		4,560	4,392	4,494	4,591	4,513	...	4,065	3,960	3,640	3,859	4,069	...	4	4,069	− 444
Kalgoorlie... ...		2,398	2,362	2,308	...	...	...	2,538	2,636	2,437	...	...	...	26	14,214	+ 1,924
La Plata		...	...	5,187	5,425	5,811	...	...	...	5,883	6,643	6,470	...	34	52,424	+ 13,296
Manila ...	$	279,534	293,873	310,559	305,126	297,128	...	286,044	273,218	291,434	291,093	298,788	...	34	2,344,427	− 67,950
Monte Video ...		46,189	46,579	42,960	42,411	44,672	...	47,960	48,074	44,298	48,672	46,463	...	43	466,926	+ 3,427
Para		22,289	22,705	22,833	22,605	20,890	...	23,061	23,651	23,942	23,862	24,050	...	39	208,012	+ 5,472
Port Elizabeth ...		7,082	6,304	6,180	6,515	6,324	...	6,892	6,713	6,412	6,623	6,578	...	—	—	—
Rangoon ...	Rs.	125,163	138,950	130,000	133,536	133,000	...	139,375	145,450	140,400	140,250	137,738	...	35	1,122,146	+ 60,100
Winnipeg ...	$	462,378	433,836	432,894	390,109	393,823	...	435,058	427,880	405,688	397,684	399,498	...	34	3,502,142	− 72,460

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OUR Service Lorries, a fleet of which patrol the whole country, collect a fund of invaluable data. This is applied to the further improvement of the A.E.C.

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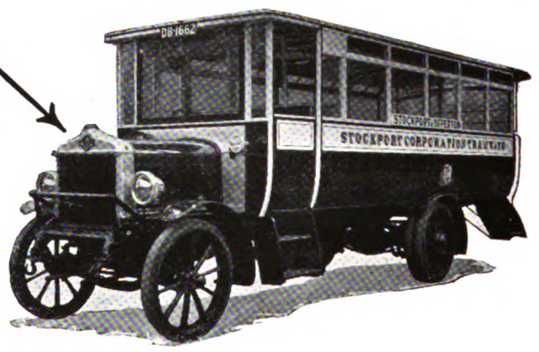

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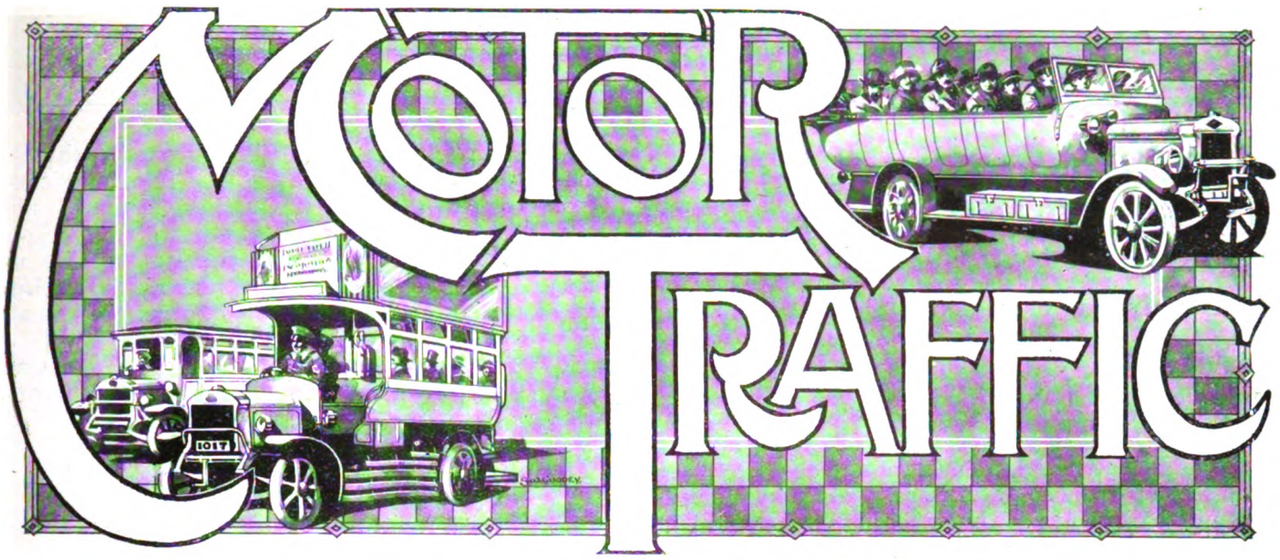

MOTOR TRAFFIC SECTION—SEVENTEENTH YEAR OF PUBLICATION.

THE REDUCED PRICE OF PETROL.

The announcement in the end of September of a reduction in the price of petrol per gallon by 5d. wholesale and 5½d. retail came as an agreeable surprise to all who use motor vehicles whether for pleasure or for commercial purposes. As the reduction is one of about 20 per cent., it will be very appreciable to all users, from that great concern the London General Omnibus Company down to the owner of a bicycle with side-car. In some quarters the concession is attributed to growing competition from producers outside the "combine," some of whom sell motor spirit in bulk at considerably lower prices. The annual saving to the General Omnibus Company, with its 3,000 vehicles, must run into a very large sum. Other omnibus concerns, proprietors of touring coaches, and firms and companies carrying on goods transport by road, will all feel the benefit. That raises the question whether passenger fares and goods rates will be reduced, and it is quite probable that they will. Of course fuel is only one item in working expenses, but at the prices of petrol in recent times it has been a very big item. Its reduction, along with a continued tendency to a fall in the cost for wages and materials, ought certainly to bring about a decrease in fares and rates. Users' present stocks of motor spirit will, of course, have to be worked off before the full advantage becomes apparent.

MOTOR CARS ON RAILS.

A type of vehicle which, though still comparatively uncommon, is by no means unknown, is that formed by placing a motor chassis on flanged wheels and effecting the changes necessary to render it suitable to run on rails. We thus obtain the basis of a small passenger-carrying vehicle for use on railway or tramway tracks. From one point of view the compromise appears to be a curious one, inasmuch as we deliberately sacrifice one of the greatest advantages of the road vehicle, namely, its flexibility. Moreover, from the standpoint of operating cost per passenger carried, we fall far short of the ideal, by refraining from utilising a large unit or from drawing power from a single central source. It might be said that we are deliberately combining the disadvantages and limitations of two systems, while ignoring their outstanding advantages. What, then is the *raison d'être* of this type of vehicle? Evidently its justification must depend on the importance of maintaining a frequent service by the employment of small units. If, for example, it is desired to develop passenger traffic on a branch railway line, the small unit, though less economical in theory, gives the only possible prospect of success in practice. Men whose daily work must be done in some business or industrial centre will not live half a dozen miles away at a place served only by three or four trains a day. Replace these by a ten-minute service of railed motor cars and the neighbourhood is at once ripe for development as a residential centre.

NEW OPENINGS FOR MOTOR INDUSTRY.

The above remarks draw attention to what may well become a somewhat important branch of the motor manufacturers' activities. In most of its principal features the rail motor car approximates to the road motor car. Its motive power is identical, as may also be its system of transmission, subject, perhaps, to a change in gear ratios. Most of the necessary alterations are in the nature of simplifications. To the successful manufacturer of road vehicles the production of a successful rail motor car should be an easy matter. On the other hand, the production of a road vehicle involved the study of many problems with which those concerned only with the manufacture of rail vehicles have had no occasion to become conversant. For this reason the trackless trolley car—sometimes given the misleading title of "the trackless tram"—might also be the product of the motor industry. By developing in the two directions indicated, the industry may perhaps render both the railway companies and the municipalities far more extensive customers than they can otherwise become.

FREQUENCY OF SERVICE.

In consulting the requirements of the travelling public, frequency of service must be recognised as a factor of the first importance. Time is worth money, and an infrequent service involves the loss of much

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MOTOR TRAFFIC

valuable time. At present our best example of frequency of service, carried to the farthest possible point, is to be found in the moving stairways that are replacing ordinary lifts at underground railway stations. In principle the moving stairway is, in effect, an endless chain of small slow-moving lifts, the use of which involves no delay at the top or bottom. In some circumstances the principle is to a certain extent involved in the use of motor omnibuses in preference to more capacious tramcars, or in abstaining from the regular employment of trailers behind tramcars. The trailer undoubtedly makes for economy per passenger mile, but its use should not involve a sacrifice in respect of frequency of service. Hence the limitation of the practice. Under ordinary road traffic conditions an attempt to give improved frequency is apt to lead to congestion on the roadways, and a consequent reduction in travelling speed. The effect can only be avoided by employing a system possessing the maximum of flexibility. Where frequency is highly desirable, the motor omnibus has marked advantages over the large tramcar from the standpoint of public convenience though not from that of direct economy, seeing that the best economic conditions for a tram service exist where the traffic demand is constant and heavy. Where it is lighter small tramcars have their advantages.

FORTHCOMING EXHIBITIONS

The forthcoming exhibitions at Olympia and the White City will not be without interest to those who regard motor cars and motor cycles purely as utility vehicles. The official and the business man have in the motor car a method of increasing their useful output by making fuller use of the working day. To such the lower-powered cars, built primarily with a view to economy in operation, will particularly appeal. Recent price reductions have brought figures of first cost down to an absolute minimum consistent with continued manufacture. It is, in fact, to be doubted whether in some cases the manufacturers are not facing a certain loss in order to keep their works occupied, as being preferable to the even greater loss involved by closing down. This applies perhaps even more strongly to commercial motor vehicles, the manufacturers of which have been forced into an almost untenable position by the continued flood of surplus Government vehicles. Business in vans and lorries continues inadequate, though there are signs of gradual improvement. A real revival cannot take place until export trade recovers. Of such recovery there are some signs, but improvement is retarded by the unsettled political conditions and the violently depreciated values of the currency of many countries.

UTILISING MUNICIPAL VEHICLES.

In connection with the various services that must be performed by a local authority, the possibilities of specialised motor vehicles are immense, but one of the chief problems to be solved is occasioned by the fact that the need for many such services is intermittent. To get the best out of a motor vehicle, it must be regularly employed, a reasonably high mileage being covered. Thus it becomes highly desirable that a municipal vehicle should be capable of fulfilling a considerable variety of functions. For instance, the demand for the services of street watering carts fluctuates with the seasons, and the same applies to sweepers. To give the best result, a municipal vehicle must either be ingeniously devised to perform many duties, or else a variety of detachable bodies must be provided for use in connection with a single chassis. In both these directions recent years have seen considerable advances.

REDUCTION IN PRICE OF PETROL.

Its Bearing on Fares and Freight Charges.

The motor spirit companies on September 26 reduced the price of petrol by 5d. per gallon to the dealer and by 5½d. per gallon to the consumer.

Hitherto the price of No. 1 grade petrol has been 2s. 5½d. per gallon. Motorists will now be able to purchase No. 1 grade at 2s. per gallon and No. 3 grade at 1s. 10d. per gallon throughout England and Wales, the prices in Scotland being 1d. more than English prices. In Ireland the prices are 3d. per gallon above English prices.

The price of petroleum lamp oil has also been reduced throughout the United Kingdom to the extent of 2d. per gallon.

The Commercial Motor Users' Association regards the reduction "as an agreeable surprise," and states that so far as goods vehicles are concerned it has come at the right time. "It synchronises," the Association says, "with a reduction in wages in the industry which, in London at any rate, drop 1s. per week in the last week in September, in accordance with the fall in the cost of living index figure. The haulage contractor will now be able to, and certainly will, give the public the benefit of the reductions."

Fares Under Consideration.

Officials of the coach companies in London stated that the public may rely next season upon the companies doing everything possible to ensure their patrons having the benefit of the reduction.

A representative of the London Underground and Omnibus Companies stated that "the management have for several weeks been considering reductions in fares, both of the omnibuses and underground railways, but up to the present moment no decision has been reached, and the matter is still under consideration." The London General Omnibus Company has a working fleet of 3,000 omnibuses, each using a daily average of 12 gallons of petrol. The saving in price therefore represents a large sum annually.

Price of Commercial Spirit in Bulk.

The chairman of the British Motor Spirit Company, which is not associated with the group of companies known as "the Combine," states that his company have for some time been selling commercial motor spirit in bulk at 1s. 7½d. per gallon, and the price had now been reduced to 1s. 5½d. The company did not distribute its petrol in tins, as was done by other companies; their method of distribution was by means of 500-gallon road tanks.

Substantial Saving to Municipalities.

Mr. F. W. Cable, chief of the highways department of the Westminster City Corporation, has stated that early in the present year he took steps to secure for the Council better prices than those obtainable from the Combine. The Council two months ago entered into a contract with the British Motor Spirit Company for a year's supply of some 40,000 gallons of commercial spirit at 1s. 7½d. per gallon, the contract price being subject to variations should the market price of petrol rise or fall during the period of the contract. The price was favourable, and the severe tests to which the commercial spirit was subjected demonstrated that it was equal, for the Council's purposes, to any spirit on the market, in addition to which it is a spirit quite suitable for ordinary motor car requirements. Westminster Corporation have one of the largest municipal motor fleets in the kingdom, and they appreciate an adjustment of prices favourable to local governing bodies, which will represent a substantial saving to the ratepayers.

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MOTOR TRAFFIC

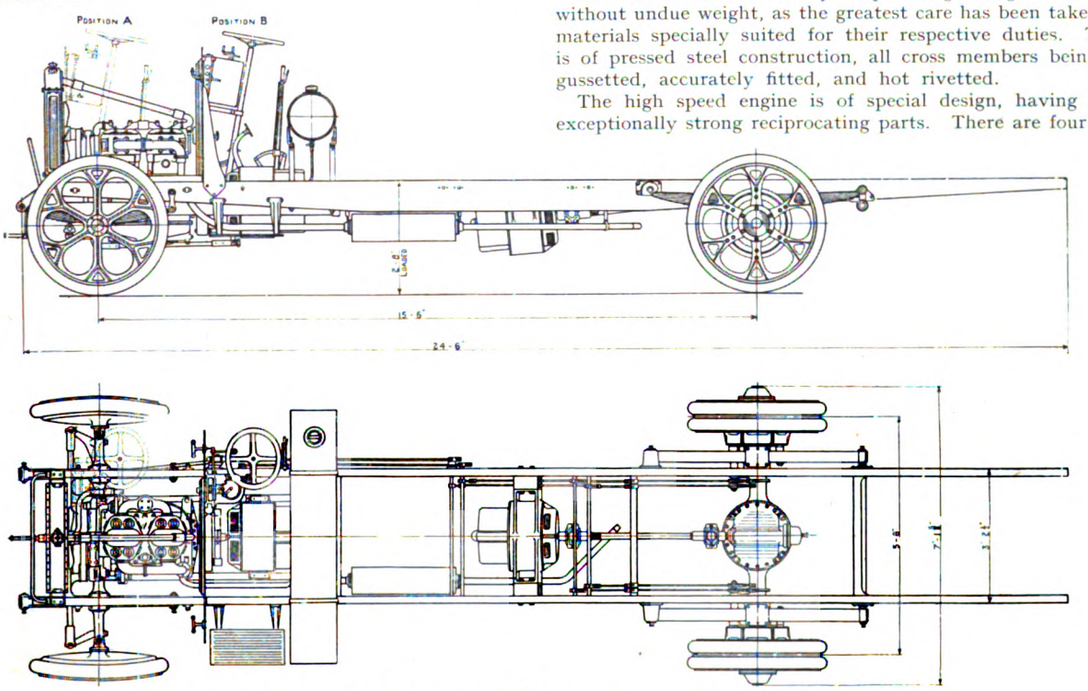
A NEW PETROL-ELECTRIC CHASSIS.

DESIGNED FOR METROPOLITAN SERVICE.

At the invitation of the designer a representative of THE TRAMWAY AND RAILWAY WORLD was recently given an opportunity of inspecting and taking part in a test run on a new design of petrol-electric chassis which is being placed upon the market by Mr. Percy Frost Smith, who for many years was associated with Tilling-Stevens Motors, Limited, of Maidstone.

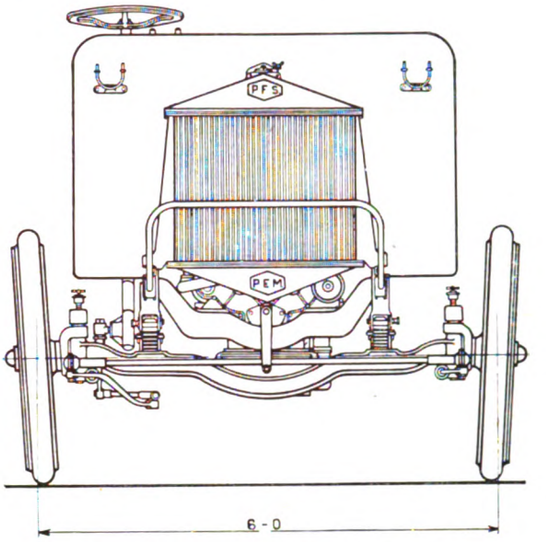
Mr. Frost Smith severed his connection with Messrs. Tilling-Stevens about a year ago, and since that time has devoted himself to the task of further perfecting the petrol-electric system of transmission, with the result that he has now evolved a model for which he claims the highest degree of simplicity, efficiency, and safety. In this model only those features have been incorporated which were uniformly successful during the past years, while special attention has been given to all details which experience has shown are important in meeting the requirements of passenger transportation. At the same time care has been taken to design a chassis sufficiently robust to commend it for general utility purposes. With the intimate knowledge of the petrol-electric system which wide experience, both as operator and manufacturer, has given him, Mr. Frost Smith has been able to embody all that has been found good in the petrol-electric chassis of the past, and in addition several features which are quite new and considerably enhance the value of the system.

The most important new feature in this chassis is the system of control. This takes the form of a patent combination controller, in the design of which Mr. Phillip V. Powell has been associated with Mr. Frost Smith. Four elements are comprised in this controller, viz., starting switch, speed regulator, electric brake, and a positive magnetic stop. The addition of electric braking and the positive means of preventing drivers from moving from a forward into a reverse or *vice-versa* position while current is flowing through the circuit are points of the greatest importance, while the successful application of an electric brake not only means an easy and safe form of control, but from an economy point of view is worthy of closest consideration.



Plan and Elevation Frost Smith Chassis Giving Principal Dimensions.

Another feature of interest is the patent three-point spring drive of the dynamo. By means of this device the load is evenly distributed on each spring, and periodic vibrations are entirely eliminated. Amongst other features worthy of special note is the exceptionally fine piece of work in the back axle. The main case is a whole-piece steel forging made by the special process of the Kirkstall Forge Company, of Leeds. Anticipating the possibility of the diameter of road wheels being compulsorily increased from that at present in use, Mr. Frost Smith has decided to employ road wheels all round of equal size, having tyres 1·030 mm. by 120 mm. twin on back and single on front. The foregoing remarks touch



Front View of Frost Smith Chassis.

upon the outstanding features of the chassis. The general design, however, gives such evidence of thoughtful care as to warrant a close study of all its details. The following brief description gives a general outline of the machine.

The chassis is of extremely simple design, of great strength, but without undue weight, as the greatest care has been taken to select materials specially suited for their respective duties. The frame is of pressed steel construction, all cross members being strongly gussetted, accurately fitted, and hot rivetted.

The high speed engine is of special design, having light but exceptionally strong reciprocating parts. There are four cylinders, cast in pairs, with bore and stroke 115 mm. and 150 mm. respectively, developing 40 H.P. at 1,000 revolutions. The crank case is of aluminium, with strong short bearer feet, the bottom half being removable; there are ample inspection covers. The crank shafts are of high tensile steel, with generous bearing surfaces. The cam shaft is arranged on one side of the engine, the valve lifters

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being of ample proportions although light in weight. "Zephyr" pistons are fitted, and provision is made for governing the speed. The forced system of lubrication is employed, the oil sump being carefully protected against dirt or foreign matter, while the oil pump and its driving gear are always submerged in oil. The "Scintilla" high tension magneto is fitted. This is of the enclosed type, giving an extraordinary spark at a very low speed, other advantages being its remarkable accessibility both with regard to the distributing gear and the contact breakers. The "Solex" carburetter is used.

The radiator is a combination of plain and gilled tubes, having a very generous cooling area. A centrifugal pump maintains the water circulation, the water pipes and connections from the pump to the engine and from the cylinder heads to the radiator being all of large diameter.

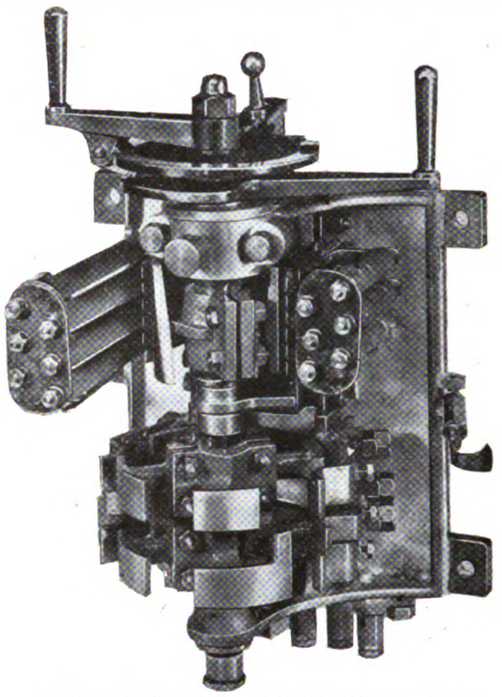
Electrical Equipment.

The dynamo is of the compound wound type, specially designed to give the characteristics required for its special purpose. The yoke is of high permeability cast-steel, having end covers of aluminium in which are fitted steel housings for the bearings, which are of the single roller type. The brush gear is the most suitable which experience has evolved for this type of machine, the greatest care having been taken in the selection of the materials as well as their application. The machine is cooled by means of an internal fan so housed that it forms a very efficient and compact arrangement. The motor is of the series wound type, and the general specification conforms to that of the dynamo. It is also interchangeable in many respects with the dynamo, inasmuch as the armatures, brush gear, bearings and housings, end covers, fans and interpole windings are identical. A feature of the motor is that it acts as a brace across the main frame, the yoke being bolted from main member to main member.

The patent combination controller, as already noted, is an entirely new and novel feature; it is housed in one case, forming a self-contained unit. It is a simple form of starting and reversing switch, having four positions, viz., neutral, forward, reverse, and brake, the control handle being directly connected to the spindle operating the drum. The field regulation, or in other words speed regulation, is obtained by means of introducing resistance into the dynamo and motor field, and is operated by a lever directly connected to the sleeve operating the segments which "cut in or out" these resistances. The same lever which operates the field regulator by a continuation of the movement from the strong to the weak field position introduces the electric brake. The magnetic stop, an automatic device of simple design and absolute reliability, renders it impossible for a driver to alter his "starter" position while current is flowing through its electrical circuit.

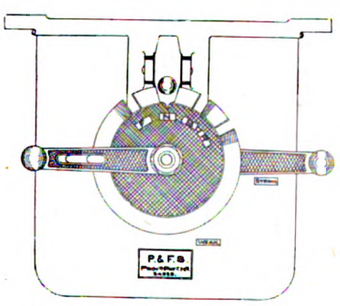
Exhaustive trials have been made with this control system by Messrs. Pickford, Limited, who have had a number of their long-distance motor coaches fitted, and in every case complete satisfaction has been obtained.

Another ingenious electrical fitment is the automatic cut-out and pole changer. The object of this invention is to regulate the lighting

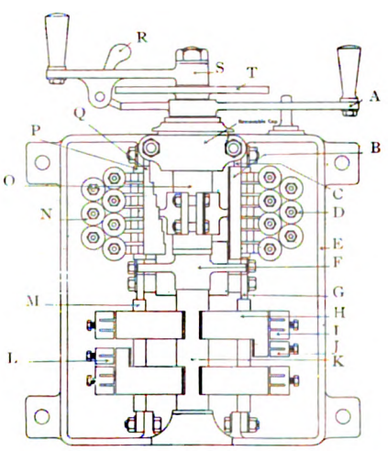


P. & F. S. Patent Combination Controller.

system. Provision for the electric lighting of the vehicle is by means of current taken from the main generator, the amount of current necessary being supplied to a storage battery which is placed across the main "outers" of the generator, and regulated by a fixed resistance. The apparatus provides means of cutting off the current when the E.M.F. of the generator falls below that of the battery, and also to provide means by which if the generator should be reversed in polarity, this will be corrected, so that the battery



Driver's View of Controller.



A Dynamo and Motor-field and Brake Lever.
B Motor-field Resistance Contact Segment.
C Removable Bar carrying Contacts and Motor and Brake Resistance Units.
D Motor-field and Brake Resistance Units.
E MAIN FRAME OF ALUMINIUM.
F Magnetic Locking Sector Plate.
G Removable Bar carrying Main and Brake Contacts.
H Reversing Switch Contact Drum.
I Main Contacts.
J Brake Contact.
K Insulated Switch Spindle.
L Brake Contact.
M Removable Bar carrying Main and Brake Contacts.
N Dynamo-field Resistance Units.
O Insulated Sleeve carrying Contact Segments.
P Removable Bar carrying Contacts and Dynamo Resistance Units.
Q Dynamo-field Resistance Contact Segment.
R Brake Locating Trigger.
S Reversing Switch Lever.
T Indicator Plate.

General Arrangement of Control Gear of Frost Smith Chassis.

The great advantage of the electric brake may be gathered from the fact that the driver has complete control of his vehicle without recourse to his mechanical brakes down to a road speed of $2\frac{1}{2}$ miles per hour regardless of the severity of the gradient. It also provides a soft, easy method of reducing speed when coasting down hills, and at the same time eliminates the wear on brake linings and the consequent high cost of renewals of brake fabrics and brake drums.

will always function correctly. The construction of the apparatus is briefly as follows—Two solenoids are provided, which are energised through a suitable switch from the "outers" of the dynamo; the plungers of the solenoids are permanent magnets connected at the centre by a crosshead of non-magnetic material. The position of the crosshead is maintained centrally by means of a flat U-shaped spring. The arms of the crosshead carries.

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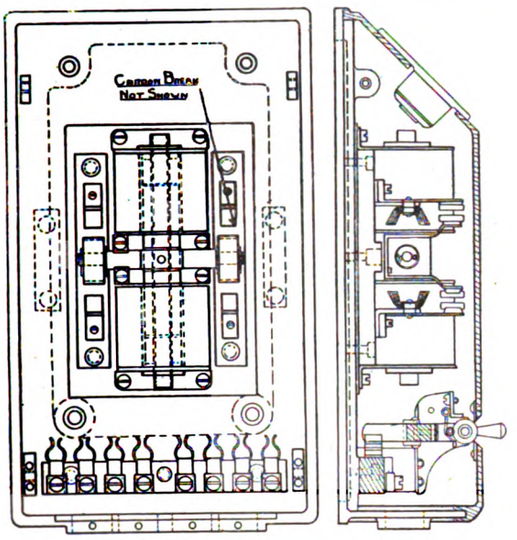
insulated contacts which in operation makes contact with either pair of brushes, which are mounted on insulated bases, connection with the dynamo being made by flexible connections. In practice, the battery being disconnected, the generator is run up, the changing switches closed, and at a predetermined voltage the solenoids are energised. The solenoid plungers are attracted either up or down in relation to the polarity of the dynamo. The insulated contacts are thus brought into contact with one or other of the brushes. On finding the correct polarity of the dynamo in relation to the polarity of the battery, the battery is then permanently connected to the circuit, and charging commences. When the E.M.F. of the dynamo falls below a predetermined voltage, the U spring will bring the insulated contacts to a neutral position, thus breaking the circuit to the battery. Should the dynamo build up its E.M.F. in the opposite direction, contact will be made with the opposite pair of brushes, and by means of cross connections the battery will receive its charge in the right direction. It is of interest to note that all lighting wires are lead-covered.

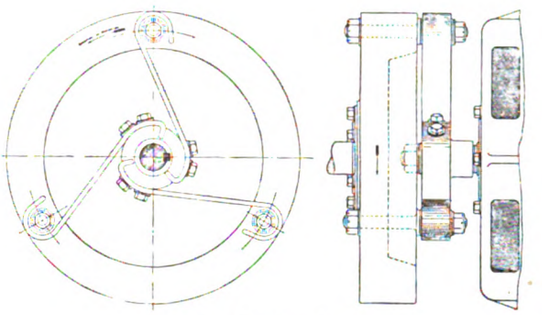


Automatic Cut-out and Pole Changer.

The connection between the engine and dynamo is a three-point spring drive coupling; this is of novel design, simple, fool-proof, and durable. As will be seen by the illustration, the load is automatically taken equally by the three driving springs, no load being taken by the set screws, which merely secure the springs to the driving hub. From the electric motor to the back axle the propeller shaft forms a direct mechanical connection. There are two roller bearing universal joints, the cardan shaft having one splined end free to move as required through its universal joint.

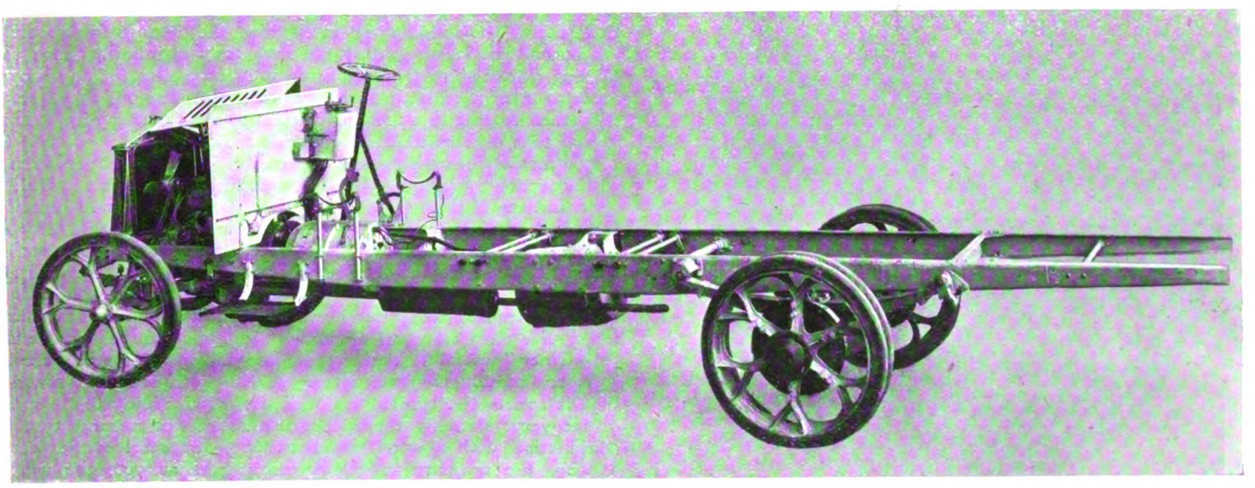
As already stated, the back axle case is an all-steel pressing of high tensile steel; this, after machining, is specially heat treated. The spring and brake brackets are of simple and strong construction, fitting over the axle and secured by means of circular dog clutches. Separate hard steel sleeves form the main axle journals; these prevent wear on the axle, and are easily renewable. This design permits of the elimination of torque and radius rods, the braking and torque strains being taken through the springs.

The worm case unit is completely self-contained, and can easily be removed from the main axle case. The differential is of the bevel type, the cages being steel stampings and the gears of the highest quality air hardened steel. The worm and worm wheel are of robust design, the former being of chrome nickel steel, case-hardened, and the latter of specially toughened gear wheel bronze. Hoffman load and thrust bearings are employed. The driving shafts are of the highest grade chrome nickel steel, with castellated ends, the driving dogs being steel stampings suitably broached, while the drive is taken by a key milled solid from the stampings. With the exception of the steel casing the complete back axle, including the cardan shaft unit, worm and worm wheel, as well as the steering column, was designed and manufactured by David Brown and Company, Limited, of Huddersfield, under the supervision of Mr. Frost Smith.



Patent Spring Drive.

The front axle is of beam section, with axle pivots of high tensile heat-treated steel, having ample bearing surfaces. The steering is the Ackermann irreversible worm and sector type enclosed in dust-proof and oiltight casing. All joints are of the ball and socket type, with ample provision for wear. The steering column is mounted on the outside of the off-side main member, so that it can be moved forward if required to permit of the mounting of a body of maximum carrying capacity. The springing of the chassis has received special attention, both as regards design and selection of material. The rear springs are 5 ft. long by $3\frac{1}{2}$ in. broad, and have eleven leaves, while the front springs are 3 ft. 6 in. long by $2\frac{3}{4}$ in. broad with nine leaves. The road wheels are of cast-steel, having spokes of cruciform design, and, as stated, are of equal size all round.



View of the New Frost Smith Petrol-Electric Chassis.

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Two independent brake drums of one internal diameter are fitted to the rear wheels, the brakes are of the internal expanding type, all shoes being interchangeable. The brakes are operated in the usual manner, and are fully compensated. The brake adjusting rods are exterior to the main frame, and are therefore very accessible.

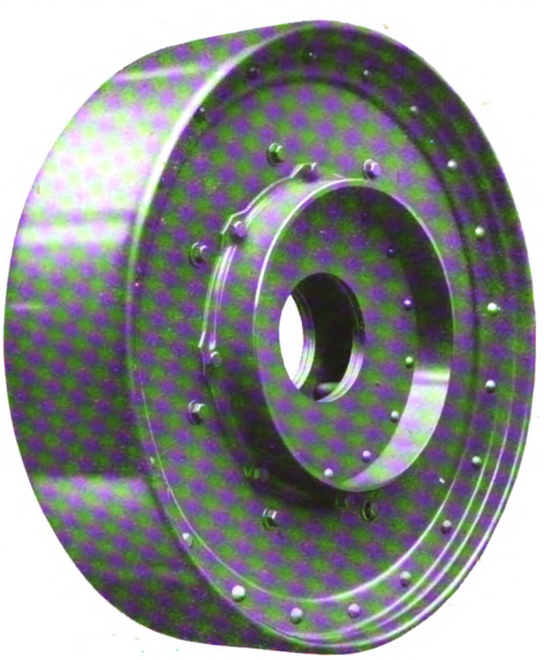
Ample opportunity is available for testing the "Frost Smith" petrol-electric chassis, as a number of "F.S." omnibuses, as they are designated, are now being put into service in London by Mr. Frost Smith for the purpose of demonstrating their suitability for omnibus services. The increasing popularity of the electric drive for passenger transportation augurs well for Mr. Frost Smith's latest venture.

CHALLINER PATENT DISC WHEELS.

At the invitation of Messrs. Shrewsbury and Challiner we recently had an opportunity of inspecting at their works at 120 Wilton Road S.W., their patent disc wheels. These have been evolved for all kinds of motor transport after much experimental work and a close study of the conditions under which modern motor vehicles are operated. The development of the motor vehicle, with its increased speed, weight and power has imposed stresses upon the wheels far beyond anything contemplated in the designs of the earlier types; indeed, so important has the consideration of this matter become that it is generally admitted that only the wheel specialist can safely be depended upon to design the right type of wheel for each particular service.

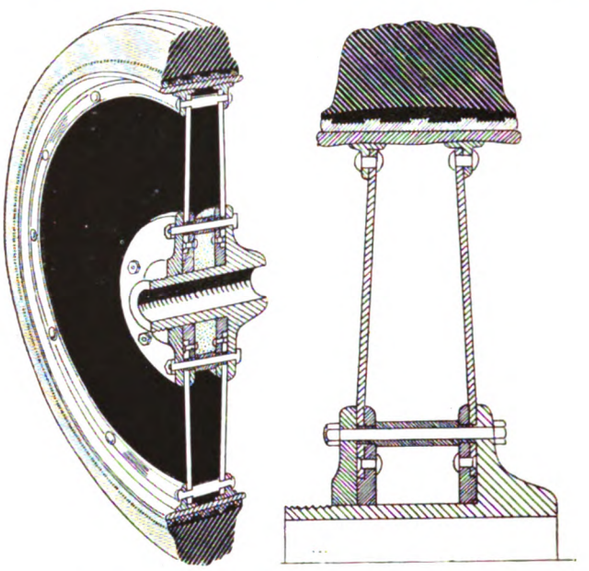
For many years Messrs. Shrewsbury and Challiner have enjoyed a high reputation as wheel makers; it is therefore a natural development of their business that the requirements of the latest forms of motor transport should receive their attention.

Experience has proved that the primary cause for the collapse of most road wheels is a sudden excessive blow or "peak" load. It is estimated that if a 3-ton vehicle running at a normal speed struck a 3-inch "pot-hole," the blow registered at the hub would be approximately 18 tons; it is obvious therefore that unless the wheel is designed to give sufficient flexibility to absorb such shocks disastrous results are bound to follow. In the case of the "Challiner" steel disc wheels it is impossible to transmit a "peak" load direct on to the axle through the wheel owing to the scientific principles which govern the construction of this wheel, and provide for the circumferential absorption of any sudden load applied. The discs of the wheel are under constant tension and therefore flexible.



Challiner Patent Disc Wheel.

The wheel is built up of mild steel, and consists primarily of two discs, two T rings, and the binding rim; it will therefore be seen that the design of the wheel is most simple in form, a most important feature being that during the whole process of manufacture the metal is in no way fatigued. To insure the successful service of a built-up wheel it is essential that the points of connection between each component part shall be practically rigid; this condition is obtained in the "Challiner" wheel without the aid of welding by the calculated resistances under tension where the various component parts of the wheels are in contact. To obtain the required tension it is necessary to put the wheel under compression, the degree of compression naturally varying with the size and form. In some instances wheels have been despatched for service carrying a circumferential compression of approximately 120 tons. The compression is, of course, the result of contraction after the rim has been put on, and only varies slightly with the atmospheric conditions. So certain is the binding effect of this compression that no other method of fixing the rim is necessary. The T rings, together with the discs, are calculated (in the cross sectional area) to balance the contractile force to the degree required in each instance. The final result of the contraction is the forming of pockets or undulations across the binding rim into which the T rings are securely ensconced. In order to test the inventor's claim that once the binding rim is pressed into position it is impossible for any movement to take place, an attempt was made to press out the T rings from their seating in a finished wheel, but after exerting a pressure of 200 tons no measurable movement took place.



Sectional Views of Challiner Disc Wheel.

The method of construction can easily be followed by reference to the sectional drawing which we reproduce. From this it will be seen that the resistance pieces not only perform the main function for which they are designed, but also prevent the possibility of any shearing effect on the binding rim, which we believe was a common fault in some earlier types of disc wheels. The reproduction of the finished wheel is from an actual photograph which demonstrates its neat appearance. This wheel has been constructed for service on a standard omnibus. An important feature of the "Challiner" wheel is that, unlike the majority of steel wheels, it is remarkably easy on tyres. It has been found in practice that it assists the tyre in its resilience, even adding to its speed of recovery. Taking the speed of recovery of a solid tyre in conjunction with a wood wheel as 800, the steel spoke wheel as 500, the ordinary make of disc wheel as 700, the wheels constructed on the "Challiner" principle would be 900. These figures are, of course, approximate, but they correctly indicate the advantage of this type of wheel. Although the principle is the same in each case, a wide variation is possible with the "Challiner" wheel. Thus for light vehicles they are built up with a single disc, while for heavy steam wagons three discs are employed. Moreover, it can be built to take any ordinary hub now in use with artillery wood wheels, so that a user desiring to convert from wood wheels to steel wheels can effect a considerable

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saving. The wheels can also be made detachable from any of the present hubs now on the market, no special attachment being necessary to fit the "Challiner" wheel. When being conducted through Messrs. Shrewsbury and Challiner's works, our representative was shown each of the processes in the preparation of the parts and the construction of the various types of wheels, from those intended for 1-ton Ford vans to the three-disc wheels intended for Foden steam wagons. He was much impressed with the soundness of the construction, the accuracy of the fitting of the machined parts, and the variety of the types of hubs to which the "Challiner" wheel could be fitted.

MOTOR VEHICLES FOR MUNICIPALITIES.

ABERDEEN TOWN COUNCIL propose to purchase a motor ambulance.

PORTSLADE URBAN COUNCIL propose to spend £800 on a fire tender and appliances.

THE INDIA OFFICE has ordered fifty 30-cwt. lorries from the Albion Motor Car Company.

BURNLEY CLEANSING COMMITTEE recommend the purchase of a one-ton motor tipping wagon.

NORTH WALSHAM URBAN COUNCIL are to go into the question of motor haulage for the fire brigade.

DARTMOUTH COUNCIL have referred a proposal to purchase a lorry at £200 to the Finance Committee.

BOLTON CLEANSING COMMITTEE are inviting tenders for the installation of an underground petrol tank.

BRADFORD FIRE BRIGADE COMMITTEE recommend the purchase of a 24-H.P. Dennis 30-cwt. chassis at £504.

MANSFIELD WATCH COMMITTEE will in March next consider the question of the purchase of a motor fire escape.

HEBDEN BRIDGE URBAN COUNCIL are applying for sanction to borrow £1,600 for the purchase of a fire engine.

EDINBURGH CORPORATION have purchased another 3-ton tipping vehicle for refuse collection from Guy Motors, Limited.

MAESTEG COUNCIL have asked the surveyor to report on the cost of acquiring mechanical vehicles for refuse collection.

ROCHDALE FIRE BRIGADE COMMITTEE have ordered the purchase of a horse pending the acquisition of a second motor pump.

SYDNEY (N.S.W.) COUNCIL have been recommended to purchase two Sentinel gully cleansing machines and four 1-ton lorries.

HAMPSHIRE MENTAL HOSPITAL COMMITTEE suggest the acquisition of a petrol fire engine to enable a sufficient supply of water to be pumped to the requisite height.

LEWISHAM GUARDIANS have been authorised by a committee to purchase three motor ambulances to enable the Board to acquire an efficient and standardised ambulance service.

SOUTHEND HEALTH COMMITTEE propose to apply to the Ministry of Health for sanction for loans of £4,069 for the purchase of three electric vehicles for refuse collection and the necessary charging plant, and £2,981 for the construction of a garage.

ST. PANCRAS COUNCIL have been advised by the Works Committee to purchase two Garrett 3½-ton electric wagons at £875 each. Other tenders received were—Clayton Wagons, Limited, two 3-ton electric vehicles, £825 each; General Vehicle Company, Limited, two 3½-ton electric vehicles, £890 each; Mossay and Company, two 3-ton Orwell vehicles, £865 each (plus extras), or two 3½-ton Orwell vehicles, £895 each (plus extras); Newton Brothers (Derby), Limited, for two 3½-4-ton Newton electrics, £1,156 10s. each.

OMNIBUS SERVICES.

BIRKENHEAD.—The Corporation have agreed to arbitration by the Ministry of Transport in regard to an omnibus service which they are proposing to run in the urban district of Bromborough.

BOURNEMOUTH.—During the year ended March 31 last the operating expenses of the omnibuses run by the tramways department amounted to £1,754, while the revenue was £1,694. The deficit of £60 compares with a loss of £151 in the preceding year. The service from Westbourne to Alum Chine was maintained during the whole year, but the Boscombe service was worked only from April to November.

BRIDLINGTON.—The Town Council have received letters from the Ministry of Transport relating to the decision of the Council that after March next no licences to ply for hire will be granted to omnibuses unless the vehicles are fitted with pneumatic tyres, and asking to be furnished with the observations of the Council upon their decision. The Watch Committee have agreed to receive a deputation on the subject.

COVENTRY.—The Corporation have decided to erect a garage and repair shops for the motor omnibus services at an estimated cost of £4,000.

HUDDERSFIELD.—The Tramways Committee have received tenders for the supply of seven single-deck omnibuses of a light type from Leyland Motors, Limited, J. I. Thornycroft, and Guy Motors, Limited. A sub-committee was appointed to meet representatives of the firms, with power to place orders. The vehicles are required in order to reduce the cost of operation during the less busy hours, and also to provide for routes where the traffic is not sufficient for the ordinary type of omnibus.

HULL.—Complaints having been received of damage to property caused by the vibration set up by motor omnibuses, the Hull Tramways Committee have decided to fit their omnibuses with super-resilient tyres, and, if possible, to lengthen the springs of the back axles.

LINCOLN.—Lindsey County Council have been informed by their Highways Committee that the Lincoln Corporation omnibuses have been running outside the borough boundaries without the consent of the County Council. The Borough Council have been informed that the right to run in the county is not admitted, and that they will be held liable. The County Council are ascertaining the views of other authorities whose roads are being used by the omnibuses.

LONDON.—A company has recently been registered, under the title of the Chocolate Express Omnibus Company, Limited, to run omnibuses in London. The capital is £15,000, divided into 15,000 shares of £1 each, and it is stated that the promoters propose to offer shares to the public with a view to obtaining capital to run additional vehicles. The originators of the scheme are the three ex-service men who for two months have been running a Leyland double-deck vehicle between the City and Victoria.

MANCHESTER.—Representatives of the Tramways and Watch Committees are considering the question of congestion of the central area of the city. The Watch Committee suggest that the tramways should be taken up in that district, and the various tramways be linked up by omnibus services. Neither the Tramways Committee nor the public favour this suggestion. Instructions have been given to the city engineer to prepare plans of the first and second class streets, with a view to seeing whether relief can be gained by a scheme of widening.

MIDDLESBROUGH.—At a meeting of the Middlesbrough Tramways Committee, the advisability of continuing the omnibus services was raised. It was suggested that arrangements could be made of an advantageous kind with a private company, in which an equal service could be retained, and that any profit likely to be made on the tramways would be lost on the omnibuses. The appointment of a sub-committee to go into the matter was agreed.

ROTHERHAM.—In order to provide communication with the new housing estate, Rotherham Tramways Committee have placed an order with Guy Motors, Limited, for an omnibus chassis at £365. A body has been obtained locally for £128. Consideration of the advisability of purchasing five additional omnibuses for the same service has been deferred.

SOUTH SHIELDS.—The Tramways Committee report a loss of £2,131 on the omnibus department during the past financial year.

SWANSEA.—The Watch Committee have given permission to the South Wales Transport Company to provide an omnibus service on a new route between Clydach and Heath Road.

YEOVIL.—The Rural Council have informed the National Omnibus Company that vehicles licensed to carry 28 or 30 passengers sometimes carry double that number.

WEST SUSSEX.—Westhampnett Rural Council report that they should obtain power to regulate the omnibus services in the area, and propose to apply to the Ministry of Health for an Order to put in force such provisions of the Towns Police Clauses Act, 1847, as may be applicable.

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MOTOR TRAFFIC NOTES.

OMNIBUS STATION AT MAIDSTONE.—For the convenience of omnibus passengers at Maidstone, a station has been erected, providing a booking office, covered platform, cloak-rooms, etc.

RUBBER ROAD EXPERIMENT.—Edinburgh Corporation have arranged to experiment with rubber roads in two thoroughfares adjoining the premises of the North British Rubber Company, who will supply rubber blocks for the purpose.

STOPPING PLACES FOR OMNIBUSES.—As the result of the prosecution of two omnibus drivers for alleged obstruction at Castle Donington, the magistrates asked the Chief Constable to arrange in every rural centre places at which omnibuses may stop.

VEHICLES PASSING TRAMCARS.—The Trades Council of Nottingham have asked the Watch Committee to make a by-law to prevent vehicles passing tramcars on the near side when passengers are boarding or alighting. Protection for school exits on important roads is also asked for.

CAR FOR CHAIRMAN OF THE LONDON COUNTY COUNCIL.—Arrangements have been made with Crossley Motors, Limited, to supply a car for the use of the chairman of the London County Council on the basis of 8,000 miles, at £660 a year. For any excess mileage the petrol alone will be paid for.

AN OPENING FOR BRITISH CARS.—The Federation of British Industries reports that a census of motor cars in Palestine shows that there is only one British car in Haifa, a seaport with a population exceeding 20,000. Throughout the country British cars are almost unknown, the majority coming from the U.S.A.

"ROAD" CHARGE IN MESOPOTAMIA.—What are termed motor omnibuses are running between Bagdad and Aleppo. The bodies have been built locally to seat eight passengers, the chassis being those of old 1-ton lorries, doubtless from the expeditionary force. In return for a lump sum down, the principal desert sheikhs have undertaken not to molest the vehicles.

PETROL TRACTION ON FRENCH RAILWAYS.—In experiments made on French railways with a petrol engine drawing a carriage weighing six tons, an average speed of over 30 miles an hour was attained on the level over a total distance of 800 miles. For the purpose of economical working it has been decided in the case of light trains to replace steam traction by petrol-driven motors.

UNLICENSED OMNIBUS.—At Croydon County Bench on September 16, two men were each fined 5s. for plying for hire on Mitcham fair day with unlicensed vehicles. They admitted the offence, and one stated that he was running to Streatham with a single-deck machine formerly belonging to the London General Company, which he had bought on the hire purchase system from a dealer.

HIGHWAY CONSTRUCTION IN ONTARIO.—During the next few years the Ontario Government propose to carry out the construction of highways throughout the province at a cost of 32,000,000 dollars. The revenue from automobile licences last year amounted to 3,000,000 dollars, and the Minister for Roads has stated that it is proposed to turn part of this back for the improvement of the leading highways of the Province, in order to encourage motor traffic.

PETROL RAIL CARS IN CANADA.—The management of the Canadian National Railways have been considering the use of petrol-driven cars on branch lines to meet the severe competition of motor truck operation. The Minister of Railways says that a good deal will depend upon the attitude that railway labour takes towards rail car operation. The railway interests would welcome co-operation of the men, so that an efficient service could be given branch lines at a reasonable cost.

INDIAN TAX ON BRITISH VEHICLES.—The *ad valorem* duty of 30 per cent. on imported motor cars in India, imposed in April last, resulted in the value of imported cars falling by £213,000 in April and May, as compared with the corresponding months of 1921. The gain to the revenue was £3,000. The duty has made British car prices almost prohibitive. In April and May 1921, Britain's share of the import business was 50 per cent., while the United States' share was 22 per cent. In the same months of the present year England's share fell to 25 per cent., and America's rose to 60 per cent.

COMPETITION IN THE U.S.A.—In an address to the members of the Traffic Club of St. Louis, Mr. A. C. Hilton, vice-president of the St. Louis and San Francisco Railroad, advised a close study of the motor industry, which, he said, is playing havoc with the receipts of the railroads. He suggested the appointment of a national committee to begin a campaign to secure drastic regulations for motor trucks and omnibuses, and to see that those engaged in competition with railroads pay their share of the tax burden now largely shouldered by the railroads.

IMPORTS AND EXPORTS OF CARS AND PARTS.—According to the Board of Trade returns, the values of cars, chassis, and parts imported during August show a falling off of £18,464 as against those imported in July, but comparing last month's values with those of August 1921, there is an increase of £53,148. In the eight months of this year there is a decline of £1,351,657 compared with 1921, and a decrease of £12,381,609 in 1922 contrasted with 1920. Exports of motor cars, chassis, and parts continue to be depressing. The August and July figures are practically the same, the values for August being only £196 above those for July. Comparing August of this year with the same month of 1921 there is a decline of £43,302, and for the eight months there is a fall of £746,539.

FOURTH INTERNATIONAL ROAD CONGRESS.

In connection with this congress, which is to be held at Seville in May 1923, a preliminary meeting was held at the Ministry of Transport, and attended by delegates of various representative associations of highway authorities, motoring organisations, contractors' federations, etc. A welcome was extended to the delegates by the Earl of Crawford, Kt., Minister of Transport, and Mr. A. Neal, M.P., Parliamentary secretary, both of whom emphasised the Government's sense of the importance of the congress and their desire that the United Kingdom should be adequately represented on that occasion. The congress is officially convened by the Spanish Government, and is under the patronage of the King of Spain. It is anticipated that even greater success will attend this congress than was the case in 1908, 1910 and 1913, at Paris, Brussels, and London respectively. In 1913 the congress was attended by official representatives of 44 Governments. As the result of the meeting a British committee was elected with headquarters at 15 Dartmouth Street, London, S.W.1, from which address printed particulars will be issued at an early date.

NEW DUNLOP PROGRAMME FOR 1923.

The Dunlop Rubber Company announces remarkable price reductions for all lines. Particularly noticeable are the drastic cuts in the prices of pneumatic motor tyres, many sizes of cord construction being actually below pre-war prices of canvas tyres, whilst tube prices are practically 50 per cent. below pre-war, and there is no doubt that the Dunlop Company have given a lead to the trade that will be far-reaching in its effects.

In motor car tyres the policy is "all-cord." The new pattern Dunlop cord tyre, which will supplement the already popular Magnum cord, is similar in appearance to the Dunlop straight side tyre, which has, of course, been on the market for some time. For the new tread design it is claimed that it is a particularly efficient non-skid, unequalled in durability, and both clean and silent.

For commercial vehicles a most comprehensive range is being marketed, including, in addition to standard solid tyres, giant singles in both standard and super-cushion qualities, and giant pneumatics of the straight side type. Alternative pneumatic equipment in the shape of twin tyres of the beaded edge type is also offered.

Mention must also be made of the range of Dunlop detachable wheels, which are supplied with either beaded edge or straight side rims in pressed steel and wire types.

Altogether a remarkable programme which should achieve its object of keeping the name of Dunlop at the head of an industry which gives employment to thousands of British workers.

SCARBOROUGH CAR SUMMONSES.

The Scarborough magistrates have imposed fines of £1 on each of six summonses, with £3 5s. costs, upon the Scarborough Tramway Company, and Mr. H. Seaton, the managing director of the company, in respect of the running of certain unlicensed passenger motor vehicles, which have been described as "toast racks." Several other similar summonses against the same defendants were withdrawn.

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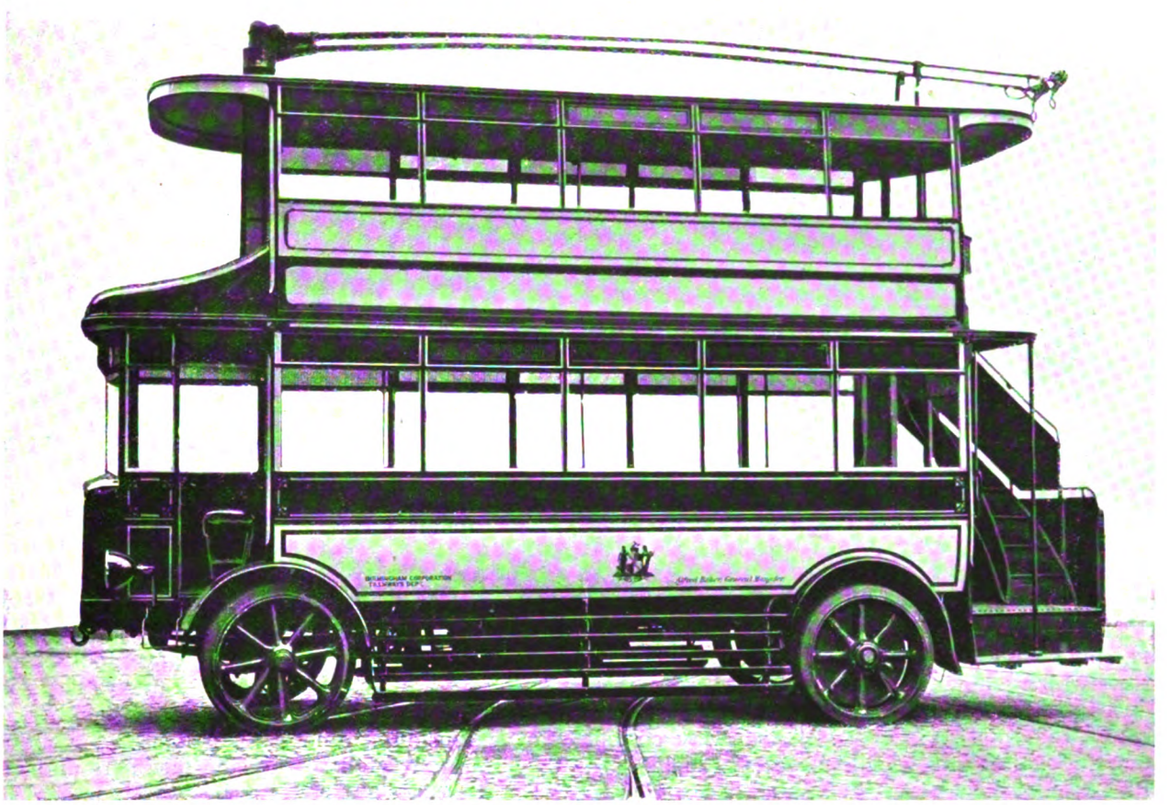
THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, NOVEMBER 16, 1922. Vol. LII.

BIRMINGHAM RAILLESS TROLLEY INSTALLATION.

The most important service of railless trolley cars yet introduced in this or any other country has just been commenced by the Birmingham Corporation tramways department. The route extends from Old Square in the centre of the city to Nechells, a suburban district about three miles to the north-east, and cars run between these termini at intervals of four minutes. exactly the same service as an ordinary tramway car on a route of heavy traffic, and the test will show without doubt that the field open to railless traction is more extensive than has been generally appreciated.

The decision to replace tramway cars with railless vehicles was taken only after very careful consideration of all the existing conditions. On the Nechells route



Double-Deck Railless Trolley Car—Birmingham Corporation Tramways.

The tramway cars which have served this route for many years have been withdrawn for use elsewhere, and double-deck railless cars have been substituted for them. Much of the track has been removed, and the remainder will be taken up in the streets where the service is carried on exclusively by railless vehicles. The route presents all the characteristics of an ordinary tramway. It passes through narrow streets, some of which are paved with stone and with uneven surface, containing varying gradients, one of the steepest being 1 in 11. The railless cars have thus to provide the rails were practically worn out, and about a year ago the tramways department was faced with the necessity for the entire reconstruction of the lines. It was, however, estimated that the cost of such reconstruction at current prices would be so great that there could be no expectation that the tramway could pay its way. In fact, the most careful estimates showed that after paying interest and sinking fund on the additional capital that would be required for reconstruction, there would be a deficit of over £3,000 per annum. This was a matter of such grave concern

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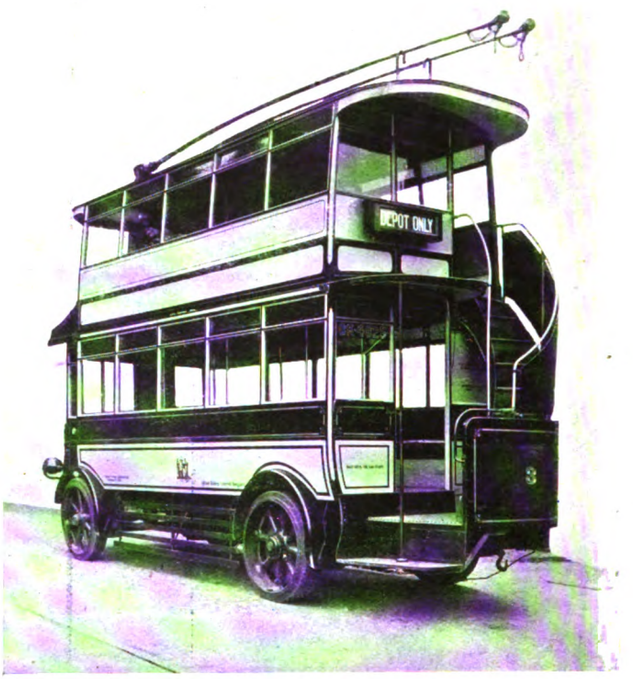
that the general manager, Mr. Alfred Baker, came to the conclusion that an experiment with railless trolley vehicles ought to be made, in view of the great saving in capital cost which could be effected by their use. Tramway poles, overhead wires, and feeder cables were, of course, already installed on the Nechells route, and the change-over from the tramway to the railless system would involve only some slight alteration to the overhead work, the removal of the tramway rails, and the purchase of the railless cars. Moreover, the cars thus released would become available for service on other routes. The proposal was laid before the Ministry of Transport, and after consideration the Corporation were informed that the Ministry would raise no objection to the introduction of railless vehicles in place of the existing tramway service on the route in question, on condition that the Corporation would include in the next Parliamentary Bill a clause authorising the running of such vehicles. The assent of the Ministry enabled the tramways department to proceed with their plans, and estimates were placed before the committee which showed that in addition to the saving in capital cost, a saving would also be effected in operating costs as compared with tramway costs.

Summarised figures showed that the cost of installing the railless system would be £54,000 less than the cost of tramway reconstruction, and after paying interest and sinking fund charges there would be a profit of £3,000 with the railless system as against an estimated loss on reconstructed tramways of £3,300.

The Tramways Committee consequently approved the general manager's proposal, and an order was placed with Railless, Limited, of London, for 12 double-deck, top-covered electric railless cars. This, it may be noted, was the first order given for cars of this type, all railless cars hitherto ordered being of the single-deck type. Double-deck cars have, however, been built by Bradford Corporation and at Leeds, but those were constructed only as an experiment to test the practicability of the idea.

The general design of the cars can be readily seen from the accompanying illustrations and drawings. They provide ample seating places for 51 passengers, 26 in the lower saloon and 25 on the upper deck, which is protected from the weather as in the ordinary tramway car. On the lower deck six transverse seats are placed on each side with a central gangway between them, and at the rear of the car on each side is one longitudinal seat for three passengers. On the upper deck there are six transverse seats on each side with a central aisle, and one seat opposite the entrance at the rear. The height of the car over the trolley standard is 16 ft. 3⅜ in., while the total length is 24 ft. 6 in., the wheel base being 13 ft. 6 in., and the over-all width 7 ft. 6 in. The weight is 7 tons 6 cwt. or 9 tons 18 cwt. when fully laden. The car has a roomy cab, which provides ample space for the driver, who is protected by a glass screen. The rear platform is also of ample dimensions. The interior finish is extremely neat, and the car is well lighted.

Front View.



Rear View.

The chassis is of special design, and is constructed of pressed mild steel channel, the frame being stiffened by cross members between the side members. The rear extension frame supporting the conductor's platform is rivetted to the side members and secured by substantial brackets to the rear members of the chassis frame. The springs are of oil-hardened ground spring steel, and the rear springs, which are of the special design of Railless, Limited, are fitted with supplementary rubber springs placed on the top of the main laminated bearing springs. These auxiliary springs come into action with the full and overload. The torque is taken on the springs. In the spring hangers of the rear springs are placed rubber shock absorbers, and the easy riding of the vehicle on an uneven road surface proves that the arrangement is very effective. The front axle is a solid steel forging. The steering wheel is covered with exonite, with special hand grips moulded on the under side. The steering gear is of the worm and nut type, with case-

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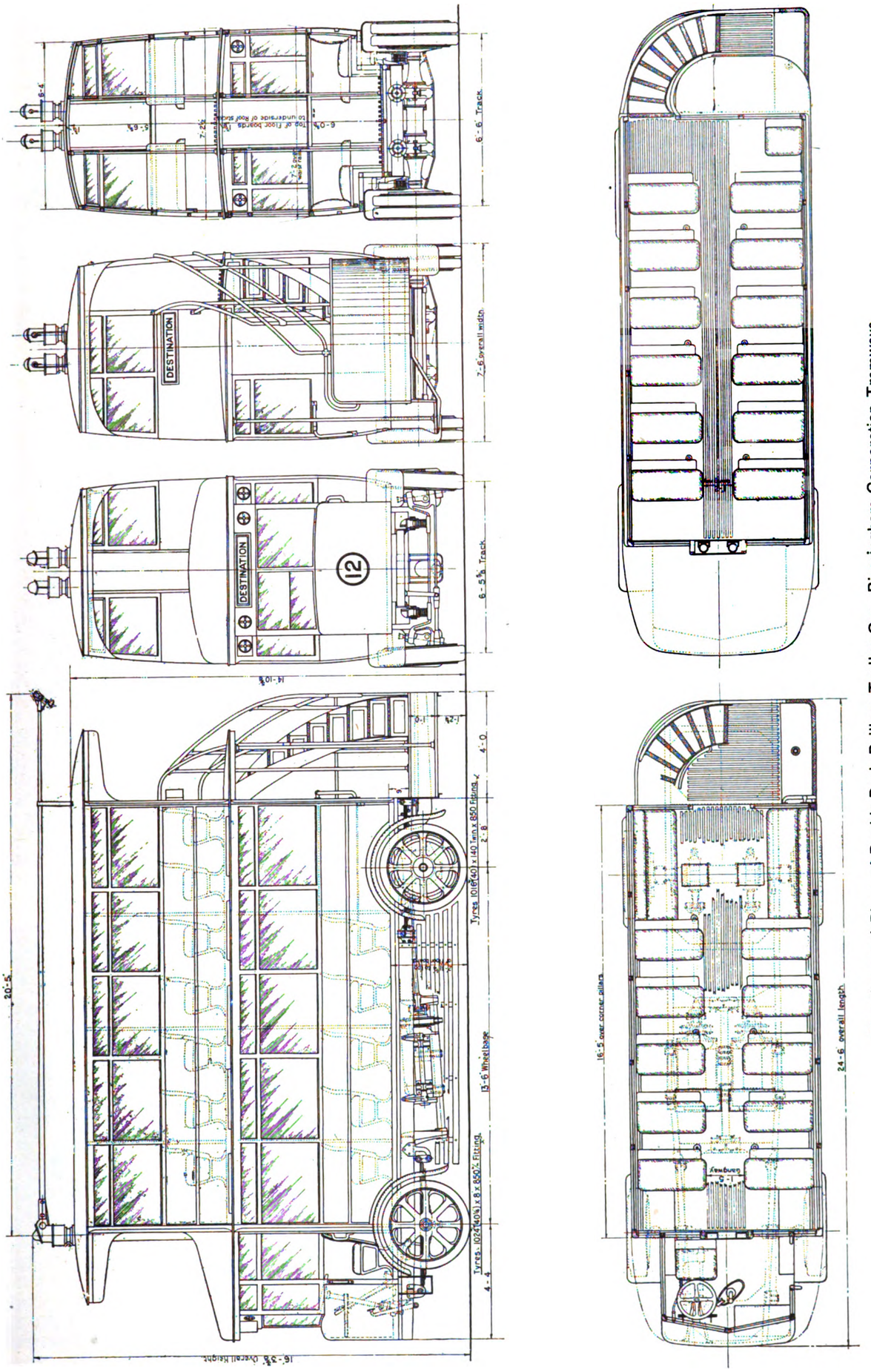

Elevations and Plans of Double-Deck Railless Trolley Car—Birmingham Corporation Tramways.

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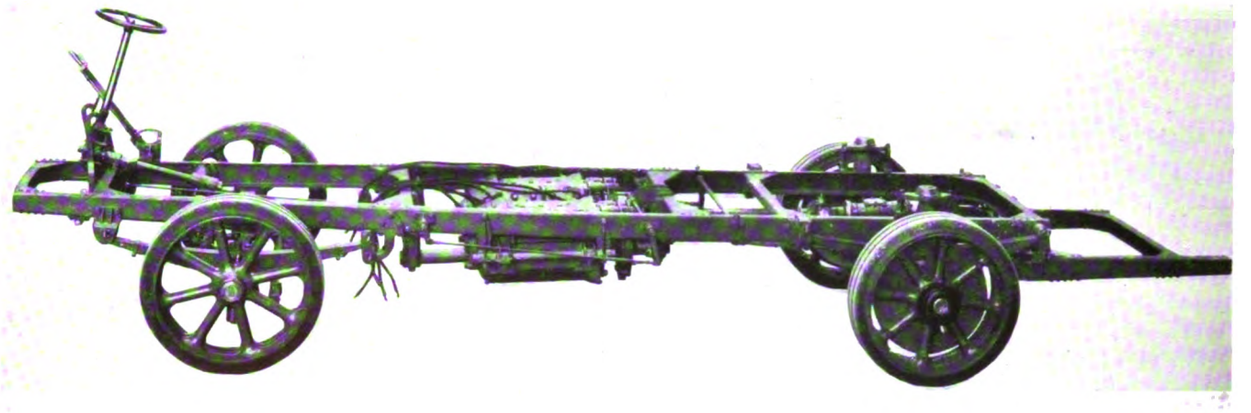
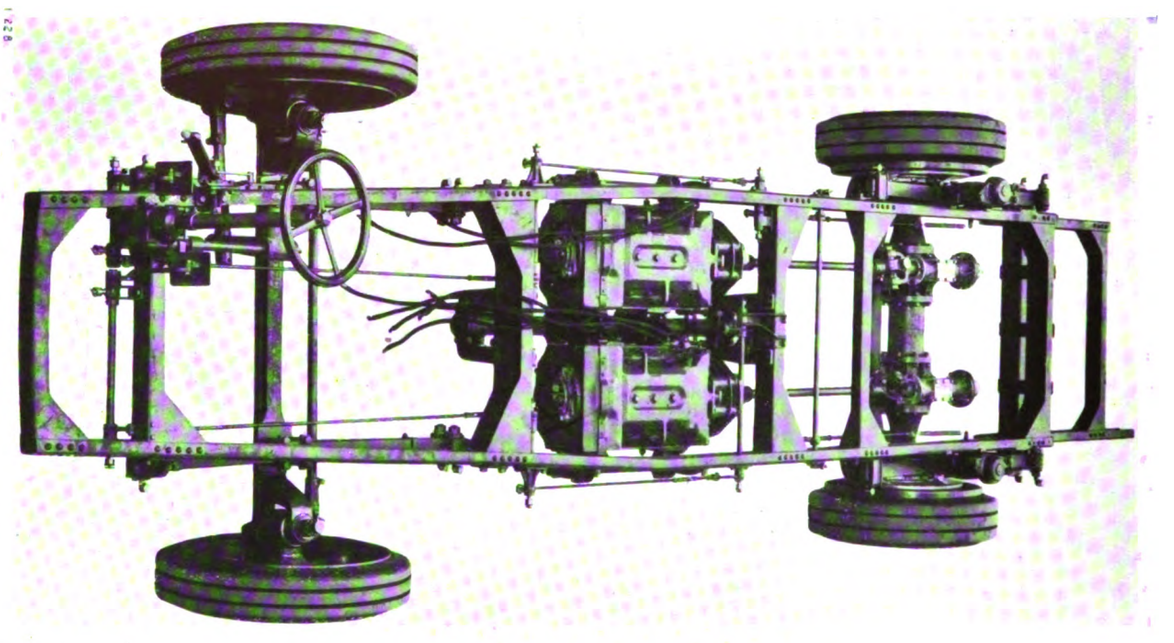
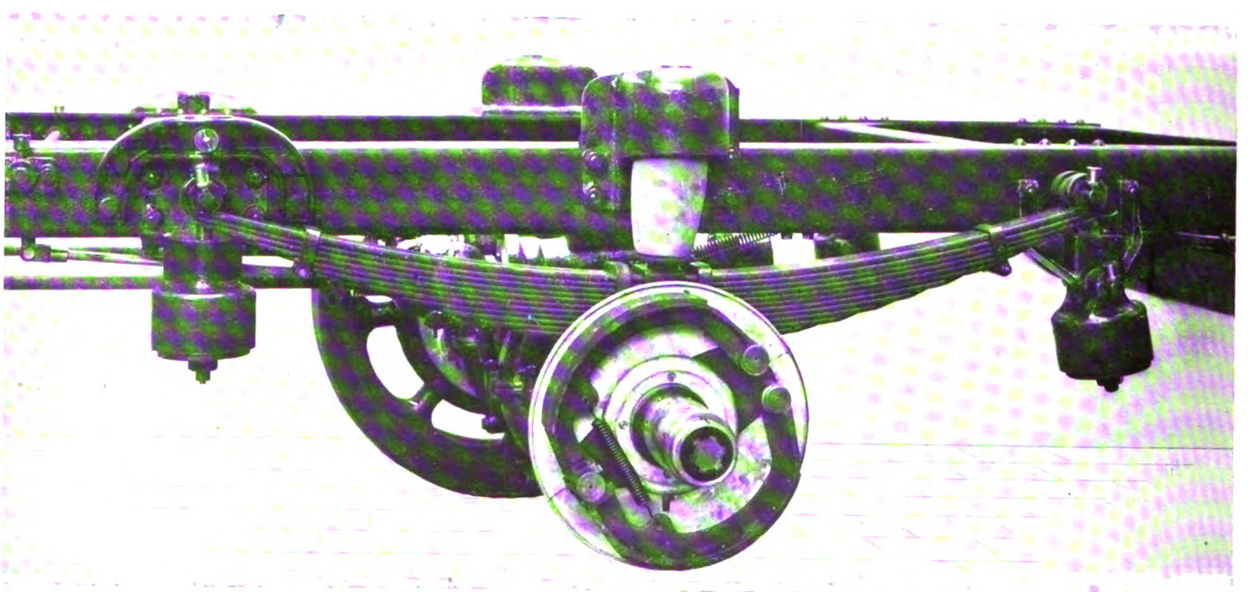


Side Elevation of Chassis of Double-Deck Railless Trolley Car.



Plan View of Chassis of Double-Deck Railless Trolley Car.



Arrangement of Springs at Rear Wheels.

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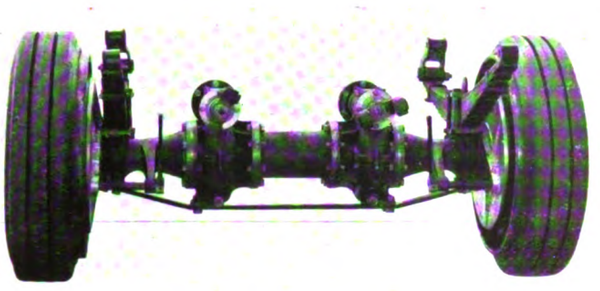
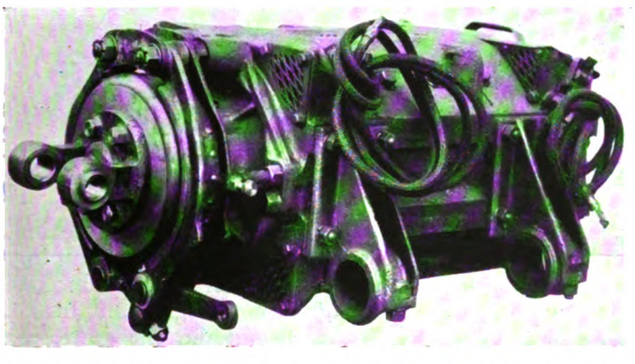
hardened steel worm and renewable nut lining of phosphor bronze contained in an oil-tight and dust-proof cast-steel case. The rear axle is of the live axle type, each road wheel being driven by a separate motor through worm reduction gear. The worm wheels are of phosphor bronze, and the worms of special



Rear Axle of Double-Deck Birmingham Railless Car with Separate Drive for Each Wheel.

steel, case-hardened and ground. Roller journal bearings, ball bearings and ball thrust bearings are used throughout. The rear road wheels are mounted on phosphor bronze floating bushes in two parts. The worm gear shafts and bearings are enclosed in an oil-tight dust-proof steel casing so constructed that the bearings and gear can be inspected without lifting the vehicle. The worm shafts are fitted with centrifugal oil throwers to prevent the oil from working out to the front end of the worm shaft, and there are arrangements for the oil to drain back into the bottom of the worm casing. The road wheels are of cast-steel with hollow spokes, with a rim diameter of 771 mm., and are fitted with Dunlop tyres. Single tyres are fitted to the front wheels, and twin tyres to the rear wheels.

There are two independent brakes, each of which is capable of controlling and stopping the vehicle when fully loaded on a 1 in 10 gradient. The rear wheel brake is of the internal expansion type, operated by a cam by means of a foot pedal from the driver's platform. Compensating links ensure equal pressure on each wheel. There is a light dust-cover over each brake drum, enabling the brake shoes to be readily

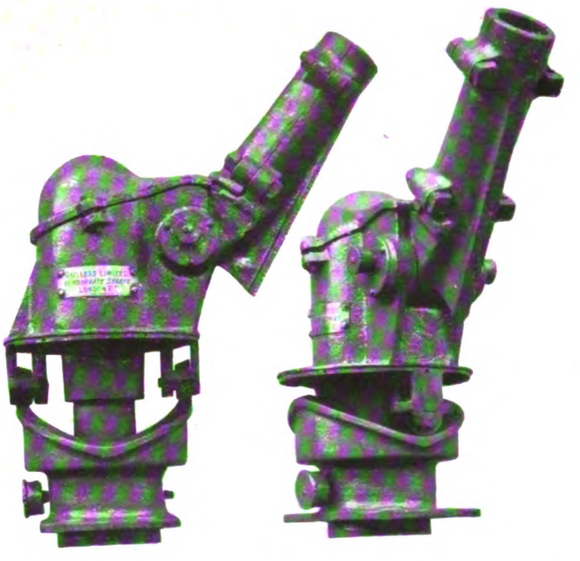


Motor of Double-Deck Railless Car with Emergency Brake.

inspected. This brake can also be operated by a hand lever with ratchet for holding the brake on after application by the foot pedal or hand lever. The external contracting brake is fitted at the driving end of each motor shaft, and is operated by a foot pedal. It is of powerful type, and is designed for use in case of emergency. The brake shoes on both brakes are lined with Ferodo.

The chassis is fitted with two electric motors made by the English Electric Company, Limited, each having a capacity of 42 B.H.P. on tramway rating at 1,130 revolutions per minute on a 525 volt circuit. The motors are series wound with four main poles and four commutator poles, and are arranged for shunt field control. They are totally enclosed by the magnet frame and two end shields. The bearings are carried in the end shield, and are provided with Hoffmann roller bearings.

The controller has a main and a reversing barrel, and provides for forward and reverse running, and for connecting the two motors in series or in parallel. Provision is made also for shunt field control and for cutting out either motor by controlling the other on the series notches. The reversing handle is detachable, but the power handle is fixed. The main barrel cannot be moved from the off position unless the reversing barrel is in one of the operating positions, while the reversing barrel cannot be moved unless the



Cam Controlled Trolley Head of Railless Cars at Birmingham.

main barrel is in the off position. The main barrel gives nine positions, in addition to the off position, five series and four parallel, and the reversing barrel a forward and a reverse.

The controlling resistances in the motor circuit are of the E.M.B. steel grid type. The circuit breakers are of the standard traction pattern. The two trolleys are of the Railless patent cam control type, fitted with ball and roller bearings. These special trolleys enable the vehicle to deviate on either side of the trolley wire to the full length of the trolley poles without risk of dewiring at any speed. The trolleys which have a low upward pressure on the trolley wires have proved very satisfactory and are giving no trouble in any respect.

The overhead wiring, which has been carried out by the Birmingham tramways department, consists of a double pair of wires, one pair for each journey outward and return, and standard tramway overhead line fittings are employed, the wires being hung from the tramway standards.

As previously mentioned, a four minutes' service is being given, and, including an average of seven stops per mile, the speed averages about ten miles per hour.

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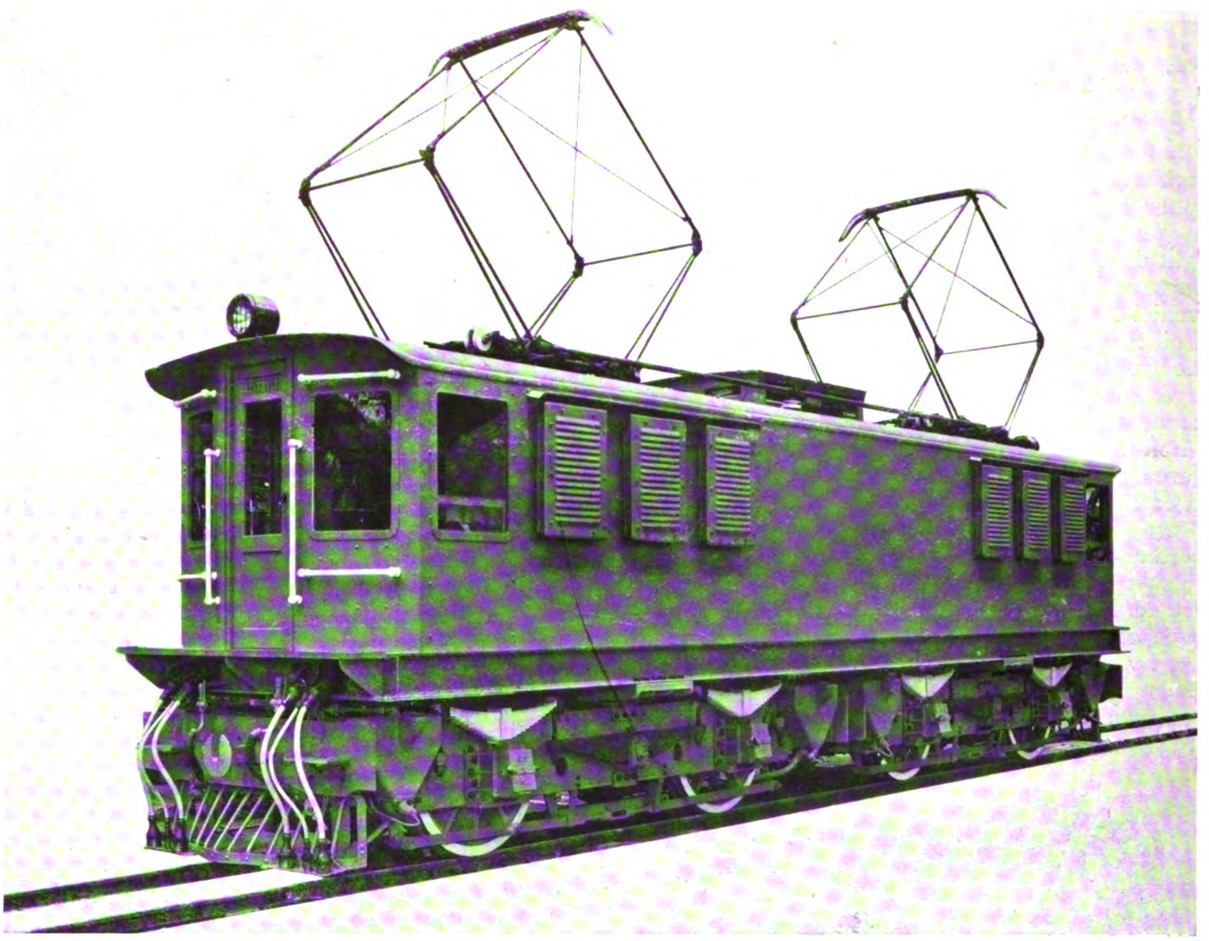
ELECTRIC LOCOMOTIVES FOR THE NEW ZEALAND MIDLAND RAILWAY.

Several electric locomotives of the type described below have been recently completed by the English Electric Company, Limited, for the Arthur's Pass section of the Midland Railway, which is situated in the South Island of New Zealand. The Arthur's Pass section is of great importance as it will form a connecting link between the eastern and western railway systems, which are separated by the Southern Alps. It is about 8·5 miles long, five miles of which consist of tunnel, and is all on a gradient of 1 in 33. Electrified goods yards are being laid out at either end.



Electric Locomotive Constructed for the New Zealand Midland Railway.

In view of the length of the tunnel and the severity of the gradients, it was decided that the section could only be operated satisfactorily by electricity, and the English Electric Company secured the contract for the supply and erection of the whole of the equipment required for the electrification, with the exception of the boiler plant for the power-house and the power-house buildings. The contract included the supply of the turbo-generators and auxiliaries for the power-house, the overhead catenary equipment, feeders, workshop equipment, five main line locomotives, and one battery locomotive for general shunting and overhead line inspection work.

The gauge of the railway is 3 ft. 6 in., and the system of supply is direct current at 1,500 volts. The overall dimensions and general particulars of the main line locomotives are given in the following table—

Gauge	3 ft. 6 in.
Weight, equipped	48 tons
Type	0—4—4—0
Length over buffer beams	35 ft. 8 in.
Width overall	7 ft. 6 in.
Height (pantographs lowered)	11 ft. 7¾ in.
Bogie wheelbase	8 ft. 9 in.
Wheel diameter (new tyres)	3 ft. 9 in.

There are four motors of the forced ventilated type, arranged in permanent series of two. The horse-power per motor at one hour rating is 170, at continuous rating 130. The drive is of the single reduction spur gearing. The control gear is of the English electric cam shaft type, arranged for multiple unit operation, and provides for series and series parallel grouping. The locomotive is equipped with four types of brakes, viz., hand-brake, Westinghouse straight air brake, Westinghouse automatic air brake and rheostatic air brake. The compressor is driven from the 120 volt circuit. Brake blocks are fitted on both sides of all wheels. The motors are ventilated by a single fan driven from the 1,500 volt supply.

The design of the locomotives was greatly influenced by the character of the line. It was considered desirable to keep to one type, and the locomotives are therefore designed for hauling both passenger and freight trains. Normally one locomotive will be used for passenger trains, but two will be used for the

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freight trains, and the locomotives are consequently designed for multiple unit operation.

The main motors are of the standard D.K. 82, totally enclosed, forced ventilated type, and develop 170 H.P. at the tread of the wheel at the one hour rating. The corresponding speed at 1,500 line volts is 18 miles per hour. They are wound for 750 volts, and connected in permanent series. The tractive effort of the locomotive is 14,200 lb. at the one hour rating.

The control gear is of the English Electric camshaft type, the main features of which are as follows—

The contactors for cutting out the starting resistance, and effecting the series and parallel grouping of the motors, are all operated by means of a series of cams, mounted on a shaft, which is rotated by a small motor through worm gearing. Only two of these contactors have to break current, and this is only the small equalising current which occurs during transition, which is carried out on the shunt principle. These two contactors only therefore are fitted with blowouts. The main circuit is always ruptured by a pair of solenoid operated line breakers, which are fitted with powerful blowouts of the Dick Kerr metallic shield type.

The camshaft motor is under the control of the master controller and of the "position regulator," which is a drum type multiway switch mounted on the end of the camshaft and revolving with it. The motor is brought to rest by short circuiting its armature under full field, which gives a very dead beat effect.

The reverser and other pieces of the control equipment are of the usual type. The camshaft type of control is extremely simple because, the sequence of operation of the contactors being mechanically defined, the use of complicated interlocks is avoided. The liability to breakdown is thus reduced to a minimum, and the cost of maintenance is extremely low. Since the control is on the "all electric" principle, no mechanics skilled in air valves, etc., are required for maintenance.

As mentioned above, the whole line is on a gradient of 1 in 33, and it is therefore imperative that the brake gear shall be absolutely reliable. The locomotives are therefore fitted with four types of brakes, viz., rheostatic brake, Westinghouse automatic air brake, Westinghouse straight air brake, and the ordinary hand brake.

Electric Locomotives for New Zealand Midland Railway under Construction at the Dick Kerr Works of the English Electric Co.

The rheostatic brake was adopted in preference to the regenerative brake because the power-house supplies the railway load only, and there would therefore be occasions when there would be no load to absorb the regenerated energy. The rheostatic brake also renders the locomotive independent of the trolley voltage. The locomotives are equipped with large resistances to dissipate the energy returned from the motors, and a solenoid operated change-over switch arranges the motor connection for "power" or "brake" as required. The change-over switch is controlled by the reversing barrel, which has additional brake positions for forward and reverse operations. The

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amount of brake resistance in circuit is adjusted by solenoid operated contactors fitted with metallic shield blowouts. These contactors are controlled by the controller handle on the series notches. The resistances are designed to limit the speed on the gradient to 26 miles an hour when two locomotives are holding a passenger train of 200 tons.

The Westinghouse brakes are supplied by a compressor of 50 cubic feet capacity, which is driven from the L.T. 120 volt supply. The 120 volt busline is fed by a 1,500/120 volt rotary transformer of 8 K.W. continuous capacity, and provides the energy for operating the control gear and lighting the train, in addition to driving the compressor. The brake blocks engage on both sides of all wheels, and the gear is arranged for hand as well as air operation.

The current is collected from the overhead line, which varies in height from 14 to 18 feet, by means of two air operated pantographs. These are raised by compressed air, and float on springs, and the range of pressure between the pantograph and the overhead line is 18 to 14 lb. between the limits of trolley wire height above.

The bogies are articulated so that none of the tractive force of the motors is taken through the underframe, an important provision when it is remembered that the tractive force will be considerable when the trains are double headed.

The locomotives are fitted with hand and air operated sanding gear. A large standby battery is carried to provide energy for the control gear and compressor motor at 120 volts. Its capacity is sufficient to enable the locomotive to make a complete trip. In the event of the 1,500 volt supply failing, the battery supply enables the driver to use the rheostatic brake as well as the air brake, and thus furnishes an additional factor of safety.

At present only five main line locomotives are required, but as the traffic increases it is anticipated that eight will eventually be needed. The battery locomotive, which is being supplied in addition to those just mentioned, is of the double bogie, central cab type, and is intended for general shunting and inspection of the overhead line equipment, to facilitate which it is fitted with an adjustable platform. The service specified required a very large battery capacity, and it was found impracticable to accommodate the whole of the battery on the locomotive. A battery tender is therefore provided, half the battery being accommodated on the locomotive and half on the tender. The two halves are interchangeable. The overall dimensions and general particulars of the locomotive and tender are as follows—

Gauge	3 ft. 6 in.
Weight equipped	36 tons
Type (central cab)	0—4—4—0
Length over buffer beams	27 ft. 8 in.
Width overall	8 ft. 5 in.
Height overall	12 ft. 0½ in.
Bogie wheelbase	6 ft. 4 in.
Wheel diameter (new tyres)	3 ft. 0½ in.

The battery locomotive is equipped with four D.K. 30 self-ventilated motors with terminal voltage of 440. The H.P. of the motors at one hour rating is 44. The type of drive is single reduction spur gearing. The controller is of the type Q.B.2, Form B, fitted with run-back preventer, notch regulator, and magnetic brake notches. The battery is of the iron-clad exide type, manufactured by the Chloride Electrical Storage Company, Limited. It has 216 cells (type L.M.V.12) arranged 108 in each compartment. The capacity is 83,600 ampere hours at five hours' rate of discharge. The battery locomotive is fitted with three brakes—magnetic track brake operated from the controller, Westinghouse straight and automatic air brake and hand-brake. The weight of the battery tender fully equipped is 20 tons, and its battery is identical with that installed on the battery locomotive.

FRENCH RAILWAY ELECTRIFICATION.

PROGRESS OF A GREAT WATER POWER SCHEMES.

On October 31 the first section, Pau-Tarbes, of the Dax-Toulouse electric railway was inaugurated by M. le Trocquer, Minister of Works. This is the first step towards the electrification of 5,600 miles of line on the Southern Railway—the Paris, Lyons and Mediterranean, and the Paris-Orleans systems. The current employed is continuous at 1,500 volts. The type of electric locomotive which is used weighs 65 tons, and with maximum load has attained a speed of 56 miles per hour. As the *Times* Paris correspondent pointed out in reporting the opening ceremony, the completion of the first line marks a definite stage in the process of the electrification of the whole of the French railway system. Frenchmen saw in the little ceremony under the shadow of the Pyrenees the promise that "white coal" will in the near future emancipate their railways and factories from dependence on foreign coal supplies. In the words of M. Le Trocquer, Minister of Public Works, "when these 5,600 miles of railway lines have been electrified it will mean that France will be economising from two to three million tons of coal annually." The electric current (continuous 1,500 volts) will be the same on all the systems, and as the locomotives and motor cars will be constructed and fitted on the same model, they will be able to run on each and every line.

M. le Trocquer further remarked that electrification would reduce the risk of accidents. "An engine-driver," he said, "remarked to me after a railway disaster, 'Smoke prevents us from seeing the signals more often than people think.' Now with electrification you have perfect visibility, as there is no smoke. You also escape being suffocated by smoke in the tunnels. Another advantage is that on single lines you have only to cut off current in order to prevent a collision. Finally, we impose upon the companies as a condition that they allow electric cables to be laid along the permanent way to bring light and power to the great cities and to remote country districts." Some idea of the power which can be generated by utilising the Pyrenean watercourses may be gathered from the following figures—The Midi Railway Company already has four generating stations at its disposal. That of La Cassagne utilises the waters of the Têt. The barrage is at an altitude of 6,500 feet, and stores 459,000,000 cubic feet of water. The force produced is 5,200 horse-power. The Fontpédrouse station produces 2,600 H.P.; the Soulom station, which receives the waters of the Gave de Pau and the Gave de Cauterets, 18,000 H.P. A scheme is now in execution to utilise the lake of Artouste, which will feed three stations and produce 130,000 H.P. Finally, the lake of Lanouse and the upper valley of the Têt will, it is estimated, produce together 170,000 H.P. Thus, in a few years the "white coal" of the Pyrenees will be furnishing the Midi Company with about 350,000 H.P., which will enable its engines to run noiselessly and without smoke at a maximum speed of 56 miles an hour.

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EDINBURGH TRAMWAY ELECTRIFICATION.

QUICK "CHANGE-OVER" IN PRINCES STREET.

Edinburgh is to be congratulated on the policy and achievements of its municipal tramways department since the tramways undertaking was acquired a few years ago by the Town Council. This fact is strikingly evidenced in the electrification scheme now nearing completion, which was adopted in April 1919, on the lines of a report presented to the Council by the tramways manager, Mr. R. S. Pilcher.

As regards Princes Street, a suggestion had been made that the tramways should be removed and transferred to George Street, with a view to avoiding the erection of overhead wires in the city's finest thoroughfare. The Town Council, however, decided to act upon the very cogently expressed opinion of the tramways manager that the service should be continued in Princes Street, because it is the main and natural artery of the city's traffic, and is also the thoroughfare to which most of the citizens wish to go. It is particularly wide and suitable for tramway traffic. It connects the two principal railway stations. It is also the point of the heaviest tramway traffic, and to have moved the lines to George Street would have put the public to inconvenience and would have placed the tramway service under a disadvantage as compared with competing forms of traffic, such as motor omnibuses. It was decided to leave the track in the centre of the roadway, and erect centre poles for carrying the wires. This decision, which was a cause of considerable controversy in the town, was eventually confirmed by the Ministry of Transport as the result of a public inquiry and a report by two inspectors.

A notable stage in the process of transformation was reached on Sunday, October 22, when the conversion of the route along Princes Street from cable to electric traction was accomplished. The work was carried out in a few hours, with promptitude and efficiency, on which the Tramways Committee and the tramway manager and the staff and workmen concerned are to be heartily congratulated. Preliminary operations had been commenced before midnight on the Saturday, and by the time that the last cable car had passed over the old track, gangs of employees of the tramway department were already at their posts, and had begun their work.

During the day part of a temporary track for east-bound cars had been laid down, and before twelve o'clock workmen had commenced to link it up at the east and west ends. This track was used while the rails on the north side of the street, which had had to be shifted to permit of the erection of the standards, were being relaid. It had been arranged that the permanent track should be ready as soon as possible by providing three squads of workmen to carry on the work night and day until completion. The poles were lying by the side of the street at intervals in readiness to be placed in position. The first of these was erected soon after twelve o'clock, almost at the foot of the Mound, amid cheers from a large crowd of onlookers, many of whom remained until the small hours.

There were about three hundred workmen employed on the conversion, including the special squads concerned with the erection of the poles and the wiring operations. Mr. Pilcher supervised the work, which proceeded continuously. The men were at intervals supplied with sandwiches and hot refreshments, so that they did not need to leave the job. By half-past nine on the Sunday morning the electric current was passing through the wires over Princes Street, and shortly afterwards the first electric car for the Gorgie route was run through. Some idea of the dimensions of the task may be gathered from the fact that in the night thirty centre poles had been erected; wiring had been completed; certain cables had been lifted; the electric connections for the various routes made; and the street lowered at a railway bridge to allow cars to pass. Some difficulties with the temporary track laid on the north side of the street having been removed, a full service of cars was running in the evening. During the Sunday large crowds of interested citizens thronged Princes Street, which certainly does not appear to have been disfigured by the presence of the tramway standards, which have been appropriately painted steel grey. It must surely be generally agreed, on practical considerations, that the case for the overhead as against the conduit method of traction is fully established. That being so, the only remaining point of controversy was the question whether the poles should be placed in the centre of the thoroughfare or at the side. In the circumstances the Corporation have probably chosen wisely in having them placed in the centre.

New Electric Tramway with Centre Poles and Overhead Wires in Princes Street, Edinburgh.

The Temporary Track is seen on the left of the poles.

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THE EDITOR will be glad to consider articles by experts. All information of a practical character relating particularly to the engineering and operating branches of transportation will receive prompt attention. Original illustrations will also be welcome.

LONDON, NOVEMBER 16, 1922.

Uniform Tramway Accounts.

The general secretary of the Municipal Tramways Association calls attention in the issue of that Association's journal for October to the want of uniformity in the presentation of municipal tramway accounts. It is a long-standing difficulty that has been felt by all those who have to examine the results attained each year, and it is surprising that more care and acumen has not been given to the matter. A great improvement was initiated many years ago, when the Municipal Tramways Association and the Institute of Municipal Treasurers and Accountants agreed upon a standard form of accounts; but although the majority of undertakings have conformed to that standard, there are a number that have neglected to do so as respects material points. If Mr. Beckett can bring the recalcitrants into line he will accomplish a useful reform. There is no serious difficulty in presenting the accounts in the simple and perspicuous way for which the standard schedule provides, and that it has not been done in all cases must be due merely to inattention to the importance of the matter. Some of the items which cause confusion appear in the gross revenue account. For instance, income tax on profits is charged as a "working expense," and this distorts the working expenses per car-mile so as to render that figure useless. The principle involved, as Mr. Beckett points out, is that only such expenses as are necessary to earn the revenue of the year are properly chargeable against the revenue earned. On this basis debt charges must be excluded from any statement of working expenses. To say that "working expenses including debt charges" are so much per mile is a contradiction in terms, because interest on loans and charges for debt redemption are not working expenses. The tramways could be run quite efficiently without them; and on the other hand, they would have to be paid if the tramways were removed and the service provided by omnibuses. In the same way items of capital expenditure, quite legitimately it may be, defrayed out of revenue should not be included in the working expenditure, of which they form no part. Mr. Beckett's criticism is made solely for the purpose of securing greater uniformity in the future in the publication of tramway accounts, and so enabling the true results of all undertakings to be readily ascertained. This object everyone concerned must wish to promote, and we hope that managers, city treasurers, and borough accountants, and all who have to deal with tramway accounts will endeavour to secure greater precision and uniformity in setting out yearly results.

Britain and the International Tramway Union.

The resumption of the international tramway congresses in October has again emphasised the inadequate interest which those responsible for British tramway enterprises take in transport matters abroad. Before the war the biennial congresses of the Union Internationale de Tramways were important and influential, but the attendance from this country was meagre in the extreme. Glasgow Corporation Tramways were regularly represented, and on different occasions a few other tramway authorities sent delegates, but with these exceptions the meetings held at various continental capitals were neglected if not ignored. At that time French and German were the official languages of the Union, and it was felt that there were great difficulties in the way of adding a third language.

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To-day the situation is somewhat different. As reconstituted last year, the Union has now only one official language, viz., French; and its membership is restricted to representatives of the countries of the *entente* and countries that preserved neutrality in the war. How long this condition may continue we need not discuss, but at the present time there is no doubt that if a large number of our tramway undertakings became members of the Union and expressed a desire that English should be made an official language, it would gladly be adopted as such by the executive. If this were done the language difficulty would be largely removed. Many years ago, on the invitation of the Tramways and Light Railways Association, the International Union met in London on the occasion of a tramway exhibition, and English was largely used in the proceedings in conjunction with other languages. Continental tramway men are as a rule better linguists than their British colleagues, and they naturally regard the question of language as of less importance; but we hope they understand that it has been the principal deterrent to membership in the Union among British tramways. It is difficult to see how the executive can deal with the matter unless the British membership is increased. Clearly considerable additional revenue would be needed to meet the expense of the publication of the voluminous official proceedings in English. It seems to us that the initiative will have to come from British interests if any change is made. Why should there not be a large addition to the membership from this country? The expense is not great; even the largest undertaking would pay considerably less than fifty pounds, while in the case of the smaller ones and for individual members the subscription is trifling. It is probable that the executive of the Union will accept the invitations extended by Glasgow Corporation to meet in that city in 1924, and we hope that before that time the British membership of the Union will be greatly enlarged. Of the recent congress at Brussels it need only be said that it was an unqualified success. The papers were useful and interesting, and the programme of visits and entertainments kept the delegates fully occupied in agreeable ways. The President, M. de Burlet, and M. Camp, who contributed so largely to the success of the meeting, were cordially congratulated by everyone.

S. E. R. Power Supply. The decision of the Electricity Commissioners refusing to sanction the application of the South Eastern and Chatham Railway Company for authority to construct an electric power-station is not altogether surprising. At the same time great interest attaches to the matter, because the finding obviously will govern other proposals which may be brought forward for the electrification of steam railways. In the past every railway company which carried out conversion from steam to electric traction followed whatever course suited it best. The London and Brighton and the North Eastern Railway Companies arranged to take their electric power from supply companies already in existence. All other railway companies electrifying their lines built their own power-stations. The decision depended on what outside sources of supply were available on attractive terms, and also on the natural desire of the railway companies to be self-contained in the matter. For the future things will be different. The Electricity Commissioners have put into force a section of the Electricity (Supply) Act 1919, which may hitherto have escaped the notice of some of the people interested. Section 11 of that Act provides that in the case of a railway company using or proposing to use electricity for traction, the Commissioners shall not refuse sanction to the company establishing a power-station unless it is proved that a joint electricity authority or authorised undertakers are willing and in a position to give the railway company an adequate and regular supply at a cost not greater than would have been incurred by the railway company in supplying themselves. In the South Eastern Railway case the Commissioners found after inquiry that there were authorised undertakers in the district (three power companies had made offers) who would be able to fulfil the conditions. Hence the refusal. The Commissioners also dwelt on the importance of pooling demands and of a general supply with a view to the prospective development of electrical supply in Greater London under a joint electricity authority.

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Glasgow's "Safety First" Campaign.

The "Safety First" campaign, which has been conducted with such excellent results in London and other cities at home and abroad during the past ten years, received early attention in Glasgow. As far back as 1914 the Corporation tramways department of that city initiated a campaign the development of which was checked by the outbreak of the great war. But the idea was not abandoned, and within the last few weeks steps have been taken to revive it. The need for "safety first" propaganda does not diminish. Indeed, the reverse is the case. The dangers of streets increase, partly, no doubt, with the growth of motor traffic. It is stated that there are now over 20,000 motor vehicles using the streets of Glasgow. A preliminary meeting has already been held to which representatives of municipal departments, railway companies, automobile societies, trade unions, and other bodies were invited. An advisory committee has been formed for the purpose of carrying on a "safety first" campaign, with the Lord Provost, Mr. T. Paxton, as convener, and Bailie M'Whirr, chairman of the Tramways Committee, as vice-convener. It is proposed to inaugurate the campaign by a "no accident week" during which the urgency of the subject may be brought home to the public mind. It was authoritatively stated that during 1921 in Glasgow 51 persons were killed and 1,087 injured by vehicles. Among the causes which, it was suggested, contributed to the occurrence of accidents were the inexperience and carelessness of some drivers of motor vehicles, public disregard of traffic in crossing the street, the presence of children on the roadway, and slow moving traffic sometimes taking the centre of the roadway. It was suggested that further powers in regard to the licensing of drivers were desirable in view of the fact that at present all a man had to do was to pay his fee and get his licence, there being no examination or test of fitness. Evidently the Glasgow traffic and transport authorities are, with their characteristic enterprise, thoroughly alive to the exigencies of the situation. There can be no doubt that their public-spirited initiative will result in the prevention of accidents which would otherwise occur, the more so if they receive from the citizens generally the response which the nature of the case demands.

Preparing for Business.

The electrical engineering industry in all its branches has reason to look with confidence to the prospects of brisk business that may be anticipated when the whole world is at peace and cause no longer exists for pouring out the money of British taxpayers on mandates that need unproductive expenditure for their maintenance. The reason for that confidence is to be found in the co-operative reorganisation that has been effected in order to enable the industry to undertake at lowest cost the carrying out of contracts at home and abroad, and if need be to finance the promotion of such undertakings. In the United Kingdom the operations of the Electricity Commissioners are paving the way for extensions on economical lines, and to some extent the grants made by the Unemployment Committee of the late Cabinet to local authorities, and the guaranteeing of interest on capital raised by private enterprise, have served to set the wheels of the industry in motion. In a lesser degree the Trade Facilities Act is important from the point of view of development of the trade of the Empire. Sir Alfred Mond, who was chairman of the Unemployed Committee of Mr. Lloyd George's Cabinet, has stated that they were about to consider a scheme for promoting a loan of £100,000,000, guaranteed by the Imperial Exchequer, the proceeds to be utilised to enable the Crown Colonies, especially in South Africa, to develop their resources. Such a policy should find wide support at a period when the disorganisation of European markets and exchanges has so greatly curtailed the normal sources of work for British manufacturers. Great satisfaction will be felt at the announcement by the new Prime Minister that he will take every possible step to develop trade with overseas countries, and especially with the constituents of the Empire. Before embarking on that undertaking the Government intend, if the Dominions approve, to summon an Economic Conference with the view of finding in what way, by mutual co-operation, an impetus can be given to Empire trade. As we have already indicated, the electrical industry will be in a position to produce the machinery to

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the fullest extent, and to finance enterprises where such a need exists. A further aid in the latter direction will now be forthcoming from the establishment of the Power Securities Corporation, which went to subscription on October 30 for a capital of £2,000,000, of which £400,000 in ordinary shares of £1 have been taken at a premium of 2s. per share by Sir W. G. Armstrong, Whitworth and Company, Babcock and Wilcox, the British Thomson-Houston Company, the directors of Balfour, Beatty and Company, and the directors of the new corporation.

CORRESPONDENCE.

THE CORRUGATION OF TRAMWAY RAILS.

Dear Sir,—The writer of the article in your September issue on this subject puts forward a very interesting theory, but has apparently overlooked much phenomena that would render his argument unstable. He bases the cause of corrugation on the fact that the tread of the rail and the face of the wheel mutually wear to an angle of about 1 in 8, and that this must necessarily lead to the wheels skidding or slipping.

When rails with British standard tread are laid on sleepers as part of a route, and no corrugation develops, what has become of the alleged slip? Again, in modern practice corrugation frequently appears directly after a route has been relaid, and it has been found that the trouble can be kept under by periodical scrubbing, the time factor between the successive scrubbings being a gradually increasing one. Here, then, we have the angle of the tread becoming more acute and at the same time the corrugation diminishing. Finally, it may be pointed out that on any large tramway system re-wheeling is carried out every day on one or other of the trucks, and if it were possible carefully to measure the exact diameters and profile of each wheel in use it is very doubtful if any two wheels would be found alike.

To my mind the basic cause of corrugation must be looked for not in the wheel but in the rail. However eccentric the wheels may be either in the matter of material, diameter, or shape, there is no known law that would compel a succession of such wheels so to synchronise in their travel as to cause a definite series of corrugation in the absence of some inciting cause from the rail itself. But once the rail holds out some special inducement for the wheels to bite better or to skid at particular points then corrugation would appear to be the natural result, irrespective of whether the wheels were perfect or not or whether they were driven or merely rolling. My contention is that this special inducement on the part of the rail is actually present in some measure on every street tramway, and that it is brought about by the coefficient of friction between the rail and the wheel being a varying factor—the variation depending on the extent to which the even vibration of the rail is interfered with by the anchors, paving, joints, etc. Experiments carefully carried out have proved to me at least that this is not merely conjecture but is the actual cause of the trouble.

Yours faithfully,

Birmingham. H. M. DUDGEON.

The writer of the article to which Mr. Dudgeon refers in his letter has sent to us the following comment—

The letter from Mr. H. M. Dudgeon appears to make little allowance for the fact that in any difficult problem there must almost necessarily be some circumstances which it may be difficult wholly to reconcile with others which preponderate. It would seem also from some of his comments that the article criticised cannot have been read very attentively by him.

Taking the first point, the case of rails laid on sleepers, your correspondent would not probably suggest that corrugation never appears under such conditions. As to the second remark, the removal of corrugation during early stages, has he never heard of, or experienced, the increased capacity to resist wear acquired by rails and tyres from the skin-hardening effect due to cold-rolling under service? This effect, so well known, must tend to lengthen the period between removal of corrugation when rails are at the beginning of their life, though the condition due to the angle of tread may in fact be gradually worsened. Both conditions referred to were clearly in mind and provided for in the first paragraph of definition in the article, in which the view was expressed that corrugation "is generally most marked where the rails have least capacity to resist wear, though the tendency to corrugation is in all cases present. . . . Other factors, such as the rigidity or flexibility of the rails or foundation, may govern the extent to which the corrugation is apparent." It would appear that the oversight as to these aspects is mainly on the part of your correspondent.

It is difficult to follow to what purpose his third comment is directed. No one with experience would doubt the differences which Mr. Dudgeon points out, while most would agree that the shape of the rails generally represents the average of all the tyres which have passed over them.

There seems to be very little real divergence of opinion between your correspondent and the writer as far as the first part of the letter from the former is concerned. Possibly therefore he will allow me to quote one passage from his article on "Rail Joints and Corrugations" which appeared in THE TRAMWAY AND RAILWAY WORLD of August 15, 1918, in which Mr. Dudgeon stated—"After all it is generally by breaking away from convention that progress is made." With this view the writer is wholly in agreement, and he had hoped that his argument, which he believed to be founded merely on sound mechanical common sense, might on this ground obtain impartial consideration and reasoned criticism.

Omnibuses and Roads.—In his annual report the county surveyor of Worcestershire states that the growth of the omnibus service was so abnormal during the twelve months that there were but 79½ miles of main roads, out of a total mileage of 442, maintained by the County Council, which were not traversed by a recognised public service. In consequence of the abnormal growth of the mechanical traffic many of the bridges were quite inadequate, and it would be necessary to rebuild or strengthen them.

Suggested Freight Clearing Houses.—In the current bulletin of the Federation of British Industries a scheme for the organisation of clearing houses for motor transport is suggested by Mr. E. S. Shrapnell Smith, president of the C.M.U.A., and chairman of the Standing Joint Committee of Mechanical Road Transport Associations. The author contends that a clearing house and freight exchange will furnish a remedy to the problem which faces 35,000 motor contractors as to what to do the better to occupy their many thousands of idle road motors. He believes that the benefits will be better, more regular earnings for owners who support the clearing houses, and lower road rates for the trader.

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THE INTERNATIONALE TRAMWAYS, LIGHT RAILWAYS AND MOTOR TRANSPORT UNION.

EIGHTEENTH CONGRESS, HELD IN BRUSSELS, OCTOBER 2 TO 7, 1922.

After an interval of ten years the "Union Internationale de Chemins de Fer d'Intérêt Local et de Transport Publics Automobiles" resumed in Brussels in October the series of biennial congresses which was interrupted by the war. The last previous congress was held in Stockholm in 1912, but papers had been prepared and all other arrangements had been completed for a meeting in Buda Pest in the autumn of 1914. The war left the Union in an impossible position, as a large proportion of the membership represented undertakings in countries against which the allies had fought, and it was necessary to effect a reconstruction. This was done in 1921 by abandoning the old organisation and forming a new Union, which provides for a membership composed exclusively of undertakings and persons representing allied and neutral countries. This reconstruction was duly carried out in conformity with the Belgian law, and a new council was appointed. The way was thus cleared for a resumption of the normal activities of the Union, and arrangements were made for holding the first post-war conference in Brussels. It was fitting that the new epoch in the history of the Union should begin there, for it was in Brussels that the Union had its birth. It was at a preliminary meeting convened in that city that the representatives of a number of Continental tramway companies decided to form a permanent international tramways union. A committee was then selected to prepare a constitution, which was adopted at the first general assembly, which was held in Berlin in September 1886.

Since that time until the war international congresses were held regularly every two years, except in 1892, when an outbreak of cholera made it necessary suddenly to cancel the arrangements for a meeting at Buda Pest. By an unhappy coincidence the meetings appointed to be held at Buda Pest have thus on two occasions had to be abandoned. Other countries visited by the Union included Paris (1900), London (1902), Vienna (1904), Milan (1906), Munich (1908), Brussels (1910), and Christiania (1912).

To the representatives of tramway enterprise in Belgium the thanks of the industry are mainly due for the reconstitution of the Union. On them has devolved the greater share of the work of reorganisation, and they also undertook the elaborate preparations for the congress which has just been held with such marked success in Brussels. As membership is now restricted to allied and neutral countries, the attendance at the congress was somewhat smaller than in pre-war times, but it included official representatives from ten Governments, and twenty-seven different nations were represented among the delegates, who numbered about 325.

The proceedings began on Monday evening, October 2, with an informal reception of the members by the president of the Union, M. C. de Burlet, and other members of the executive council and the local committee, in the salons of the Taverne Royale. A large company assembled, and the rooms presented an animated scene throughout the evening. Members who had not met one another for many years exchanged cordial greetings, and there was indeed speech in many languages. Music and refreshments were provided, and the members found the evening a pleasant introduction to the congress.

TUESDAY, OCTOBER 3.

On Tuesday morning at ten o'clock the congress was formally opened in the Palace des Academies, a fine building facing the park and the Royal Palace. Upon the platform were official representatives of the Belgian Government, including the Minister of Railways, Posts and Telegraphs, M. Neujean; the Minister of Agriculture and Public Works, M. Ruzette; M. Beco, Governor of Brabant; M. Alphonse Max, Burgomaster of Brussels; M. Lemonnier, Echerin of Public Works, Brussels, and a number of delegates of the Belgian and other Governments, including France, China, Czecho-Slovakia, Denmark, Holland, Japan and Spain.

M. Neujean, Minister of Railways, welcomed the congress on behalf of the Belgian Government. It was, he said, a great pleasure to him to be present at the opening of the congress, during which they would discuss problems that at times presented great difficulties. The development of a country was closely bound up with the question of transport. Tramways had become of immense importance in the life of great cities, and it was impossible to emphasise too strongly the utility of this means of public transport. In Belgium, he said, they had been very enterprising in the development of tramways, and abroad, particularly in South America and Egypt, Belgians had constructed numerous tramways and light railways. But throughout the world difficulties have been intensified during the past few years, and public transport had passed through an alarming crisis. All these difficulties would, however, be overcome, and he had every confidence that the result of their labours would be helpful in the development and operation of public transport services.

M. C. de Burlet, president of the International Union, then thanked the Minister of Railways for his welcome to the congress, and expressed the great satisfaction they all felt that after the terrible ordeal of the war they were able to resume again their peaceful labours. Referring to the history of the Union, he mentioned that it was in Brussels in 1885 that the Association had been created, on the initiative of M. C. Michelet, who died in 1897. Baron Janssen then became president, and continued to hold that position with conspicuous ability until 1911. What progress has been realised since the creation of their Union? From the horse-car they had passed to steam traction, and finally their locomotives were replaced by electric cars. They had unhappily been obliged to abandon the use of accumulators, which had not yet become practicable, although science without doubt had not uttered its last word in this matter. The president then passed in rapid review the important questions which the congress had from time to time considered, and he gave an interesting *resumé* of tramway development in Brussels and elsewhere, stating that in Belgium tramway and light railways had an aggregate length of about 5,000 km. The International Union studied closely every phase of transport development, and it had done important and useful work for the industry in various directions. Referring to the damage done to the Belgian tramways during the war, he said that this amounted to an immense sum.

M. C. de Burlet
President of the Internationale Tramways Union.

In Belgium the Germans had taken from the Light Railway Company over 1,700 km. of track, 479 locomotives, and nearly 6,000 wagons, and had destroyed numerous depots and workshops. The total loss suffered by this one company was estimated at 300 million francs. The president rendered homage to those who fell in the terrible years of the war. Amid loud applause he concluded his address by expressing the hope that those from whom they had felt it necessary to separate themselves because of the war would render possible a renewed union by giving indispensable moral and material satisfaction.

M. Neujean congratulated M. de Burlet upon his able address, and then withdrew. The president took the chair, and the programme of the congress was then begun.

The first paper was by M. A. Marriage (Paris), who, owing to ill-health, was unable to be present. His paper, "A Study of Comparative Expenses before and since the War of Tramways, Light Railways, and Public Motor Transport," was read by M. Bacqueyrisse. The paper contained much information in regard to expenses in various countries, and the facts were shown in detail by numerous tables. In concluding, the author said that the future seemed difficult enough for transport enterprises, but it was their duty to seek to establish an equilibrium between expenses and receipts, and to endeavour to discover improved methods of working.

M. de Hoop (Brussels) then read his paper on "The Repair of Tramway Track and Track Appliances by Electric and Other Welding Processes," a translation of which will be given in a later issue.

On the Tuesday afternoon the delegates visited Tervueren Park, to which they were conveyed in special tramway trains of the Brussels Tramway Company, consisting of a motor car and trailer. The park is about twelve miles from the centre of the city, beyond which for some distance the route lies through a dense forest and presents delightful views. After inspecting the Colonial Museum at the park, and taking tea at the pavilion there, the party returned

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M. Neujean, Belgian Minister of Railways, Opening the XVIII International Tramway Congress.

The International Tramway Congress at the Palais des Academies, Brussels.

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to Brussels. In the evening in honour of the Congress a gala performance was given in the Théatre Royal de la Monnaie of Rossini's ever popular opera, "The Barber of Seville," which was admirably rendered before an audience that filled the house from stalls to gallery, and included the staffs of the Brussels tramway companies.

WEDNESDAY, OCTOBER 4.

On the Wednesday, M. K. Norregaarde, manager of Copenhagen Tramways, who also represented the Government of Denmark, presided, and the session was devoted to the reading in English of the papers by Mr. H. E. Blain, assistant managing director of the London Underground Railways and London General Omnibus Group, on "The Organisation of Motor Omnibus Services in Great Cities," and by Mr. C. J. Spencer, general manager of the London Group of Tramway Companies, on "Modern Improvements in Tramway Rolling Stock." Mr. J. Dalrymple, general manager of Glasgow Corporation Tramways, read the former paper, after explaining that both Mr. Blain and Mr. Spencer were unavoidably detained in London in connection with labour difficulties. After reading the paper, Mr. Dalrymple remarked that he did not know why he had been asked to read the paper, unless it was because he knew nothing about the subject. In Glasgow, with one and a quarter million people, they had not a single omnibus. It was noticeable that Mr. Dalrymple's reading of Mr. Blain's paper was followed with close attention by the delegates, and the president congratulated Mr. Blain on his report, which he believed would prove most useful to the members. He also thanked Mr. Dalrymple who read the paper so distinctly. Mr. J. Beckett, general secretary of the Municipal Tramways Association, then read Mr. Spencer's paper, prefacing it with the remark that he was sure that it was a great disappointment to Mr. Spencer not to be present, but in England labour troubles were insistent. After reading the paper, Mr. Beckett said that if Mr. Spencer had been there, he would undoubtedly have referred to the question of trucks, and especially to a design that Mr. Thomas, of the Peckham Truck and Engineering Company, had with him, and a model of which Mr. Thomas would show to anyone who wished to see it.

The president then expressed his regret that those English members who had been kind enough to write papers were unable to be present. M. Bacqueyrisse, referring to Mr. Spencer's paper, did not agree that they had made no progress in car design; on the contrary, many improvements had been made, and others would follow as soon as financial conditions permitted.

An adjournment was made before noon, as the delegates were to visit Charleroi, to which they travelled by special train. On arrival, they were entertained at luncheon by the directors of the Ateliers de Constructions Electriques in the galleries of the Bourse. After luncheon the pary divided into groups, with each of which was an official of the company, who conducted them over both the old and the new works, the latter having been constructed since the war. Much work was in progress in various departments, and the visitors evinced great interest in the process of manufacture of traction motors, cables, and so forth.

In the evening the return was made to Brussels by special train, and at 10 p.m. the delegates and the ladies who accompanied them were splendidly entertained by the Brussels Tramways Company at the Hotel Astoria. A delightful concert was given, in which a number of artistes from the Théatre Royal took part, and at midnight a supper was served to which the hosts had given all the characteristics of a sumptuous banquet.

THURSDAY, OCTOBER 5.

The president of the day, M. G. Pavie, chief engineer of bridges and roads, Paris, opened the morning session at 9 a.m. The first paper dealt with "Automatic Sub-stations," and was read by its author, M. L. Sekutowicz, director of technical services of the Omnium Lyonnais, Paris, who described the operation of such stations and discussed their advantages. M. Geron then took the chair, and M. Ch. Rochat, managing director of the Geneva Electric Tramways Company, read from manuscript a long paper on "The Economic Situation of the Swiss Railways from 1913 to 1920."

M. P. N. Nieuwenhuys, manager of the Arnhem Municipal Tramways, followed with a paper on "One-man Cars."

At the afternoon session, over which M. Rochat presided, three papers were read, viz., "The Use of Mercury Arc Rectifiers in Tramway Systems," by M. Odermatt, engineer of Brown, Boveri and Company, of Baden; "The Operation of Light Railways by Rail Motor Cars," by M. J. de Croës, chief engineer and director, Société Nationale de Chemins de Fer Vicinaux, Brussels, and "The Study of Various Systems of Applying Current in the Electrification of Light Railways," by M. A. Pirard, deputy manager, General Works Company, of Liege.

On the adjournment of the afternoon session, the members proceeded to the Hotel de Ville, where they were received by M. Max, the Burgomaster of Brussels, who was accompanied by the sheriffs and several councillors.

In welcoming the visitors, M. Max alluded to the notable address of M. de Burlet in opening the Congress, and said he was confident that their proceedings would tend to useful developments in tramway and light railway services. M. de Burlet, in thanking the Burgomaster for the hospitality with which the delegates had been received, recalled, and, amid repeated applause, eloquently extolled the courageous attitude during the war of M. Max, who, as every one knew, was in the course of the German occupation deported, together with many of the Common Councillors, into German fortresses as a punishment for their resistance, which neither harsh treatment nor threats of death had been able to overcome. After taking tea, the visitors were conducted through the fine suite of rooms on the first floor, and examined with interest the paintings and magnificent old tapestry with which the walls of many of the apartments are hung. Not a few of the visitors recalled a similar visit paid to the Hotel de Ville at the International Congress of 1910, and spoke of the memorable scenes that had in the interval been enacted within its historic walls.

In the evening the delegates and ladies were entertained at a banquet in the great hall of the Madeleine, which was finely decorated for the occasion with flags of all nations represented at the Congress. M. de Burlet presided, and was supported at the head table by, among others, the Belgian Ministers, MM. Jaspar (Minister of Foreign Affairs); Neujean, Levie, Beco (Governor of Brabant); M. Max (Burgomaster of Brussels), Sir John Timpson, K.B.E., and others. After the loyal toast to the King and Queen and Royal Family of Belgium had been proposed by the President, M. Jaspar thanked those foreign Governments who had sent representatives to the Congress, and spoke at length with regard to the important aims and achievements of the Internationale Tramways Union, to which he proposed a toast. M. de Lancker, managing director of the Brussels Tramways Company, then proposed the toast of the guests, which was accorded musical honours, the band playing the National Anthem of all the countries represented amid scenes of lively enthusiasm. There were various responses to the toast. Sir John Timpson, K.B.E., president of the Municipal Tramways Association (Incorporated) of Great Britain, in replying, conveyed to the members the greetings and felicitations of the Association. In that convention they were united in a common industry, but the nations there represented were united in bonds that were indissoluble. During the war they had been comrades in arms, and he was persuaded that nothing would separate their friendship in the not less difficult times through which they were passing on the way to peace. No Britisher could visit Brussels without being moved by the recollection of the heroic part played by that gallant little nation in the mighty struggle, nor could they ever forget the illustrious name of Burgomaster Max and the unquenchable spirit manifested by him at the time of the German invasion and subsequent occupation of that city. In the name of those he had the honour to represent he respectfully saluted that name. Sir John then briefly passed in review the position of the tramway industry in Great Britain, and concluded by expressing the hope that the Congress would be the means of advancing and promoting the solidarity of their common interests.

The banquet was attended by some 400 members and guests, and the proceedings, though prolonged until nearly midnight, were in every way interesting and successful.

FRIDAY, OCTOBER 6.

On Friday morning at nine o'clock the annual business meeting of the Union was held in the Marble Hall of the Palais des Academies. M. de Burlet presided, and the business of the day was completed with despatch. M. Camp, the general secretary, presented his report, including the accounts for the years 1912 (when the last general meeting of the old association took place) to 1921. These were unanimously accepted, and the estimates for 1922-23 were approved. Several members were then elected to the committee. It was proposed that an amendment should be made to the article dealing with the "effective personal members" providing that directors, managers, engineers and higher officers who had resigned their functions, but desired to continue their connection with the Union, might do so. This amendment was agreee to unanimously.

A protracted discussion then took place in regard to the place of meeting of the next Congress. Invitations were received from various cities, and representatives from Barcelona were particularly urgent in their desire that the next meeting of the Union should take place there in 1924. There would then be an exhibition at Barcelona, and it was thought that the opportunity should be taken to organise a meeting in that city. From Paris also a pressing invitation was received; but the general opinion appeared to favour the acceptance of the invitation from Glasgow. Eventually it was agreed that the final decision should be left to the Executive Council, with the general understanding that if the circumstances were favourable the meeting in 1924 should be held in Scotland.

The adjournment took place about 11 o'clock, and soon after the members were conveyed by special cars to the Gare du Nord,

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whence they travelled by special train to Ghent, where a visit was paid to the shops of the Société d'Electricité et de Mecanique (Procédés Thomson-Houston et Carels). Before inspecting those well-known works the delegates were entertained at luncheon, when they were welcomed by the managing director and other officers of the company.

During Friday morning special cars of the Brussels Tramway Company were placed at the disposal of such delegates as desired to visit the power-station and car repair shops, or to see a demonstration of the process of the Woods Gilbert Rail Remodelling Company, Limited, at Ixelles. Work being carried out by the Rail Welding Company was also inspected by a number of the delegates.

SATURDAY, OCTOBER 7.

The programme of the concluding day of the Congress began at 8.3 a.m., and terminated about midnight. At the first mentioned hour a special train left the Gare du Nord and conveyed the delegates to Ypres, where a new town is rapidly rising on the ruins of what was once a charming old city. After visiting the cemetery, where wreaths were placed by Belgian representatives, the party viewed the ruins of the famous Cloth Hall and the remarkable work which has already been accomplished in reconstructing a part of the town. The British members of the party were enabled to realise the extent of the work by the evidence of Capt. L. C. Bellamy, M.C., who during the war was for long intervals stationed at Ypres and the neighbourhood. Sir John Timpson, who had more than once visited the district soon after the war, in connection with relief work to which he and Lady Timpson devoted themselves, vividly portrayed the utter desolation of the place after the armistice, and dwelt on the amazing courage with which the people returned to their ruined homes and began the work of restoration.

About noon luncheon was taken at the Hotel Excelsior, and afterwards M. de Burlet spoke feelingly of the fate of the city, and of the heroic efforts that were being put forth to make it habitable and to restore its prosperity. The Mayor of Ypres eloquently responded, and spoke with pride of the work already done and confidently of the future. Early in the afternoon the party proceeded by motor vehicles to Dixmude and through the devastated country along the famous battle front to Nieuport, a town totally destroyed in the war, but which has now been almost wholly rebuilt. At Westende the motor vehicles were exchanged for the handsome trains of the Ostend electric tramways, in which the visitors travelled along the sea front to Ostend, where dinner was served at the Majestic Hotel. M. Burlet then formally took leave of the members, thanking them for their attendance, and expressing his gratitude to those responsible for the organisation of the Congress, mentioning particularly M. Camp, the general secretary, and the local committee. M. Level, president of the Light Railways and Public Automobile Transport Union of France, thanked their hosts on behalf of the members of that Union, and congratulated the president on the success of the Congress. To his enthusiasm, tenacity, and experience they owed the reconstitution of the International Union. Sir John Timpson responded for the British members, and after other speeches the first post-war International Tramway Congress was concluded amid the mutual congratulations of the delegates on its brilliant success.

Demonstration of the Woods-Gilbert Rail Remodelling Process at Ixelles, Brussels.

THE AUSTRALIAN FEDERAL ARBITRATION COURT.

TRAMWAY AGITATORS' OPPORTUNITY.

Discussing tramway men's wages in Australia, the *Hobart Mercury* remarks that "it would be hard now to find any considerable number of intelligent people who would declare themselves friendly to the Federal Arbitration Court." No one apparently has a good word to say for it. Even Mr. Hughes has admitted that the Court is a failure, and will have to be put on a different footing. Employees have always found the Court objectionable, and some of the largest organisations of employees are apparently now prepared to admit that they are willing to give it up. The *Mercury* thinks that if the unions take the trouble to digest what they now know, the Arbitration Court would not be able to stand up against the feeling that would be created.

The conditions in Hobart afford a striking illustration of the way in which the court hurts by its mere existence a number of people who were well content to be left alone. An organisation calling itself the Australian Tramway Employees' Association has served on the Hobart City Council a log of wages and conditions of work which it required should be observed by the Hobart tramway authorities. The Council cannot apparently grant these conditions and it seems improbable that the association expected that they would do so. On the recommendation of the Tramways Committee the Council has decided that not only shall the demands not be granted, but that nothing is to be gained by a conference with the officials of the association. The next step was to be a filing of the claims in the Arbitration Court, the calling by its president of a compulsory conference in Melbourne, and then proceedings in the court itself. During all these preliminaries the Council as an employer has not had an opportunity of meeting the men who do the work and of discussing the position with them. The men themselves apparently had no part in the drawing up of the claims, and our contemporary says that even "if the conference were agreed to they would not be present." There is, in fact, no dispute between the City Council and the employees in the tramways department, but the whole difficulty appears to have been engineered by officials of the association residing in other States. The Council has had no difficulty with the men, and it is only by the interposition of the officials of the union that any trouble has arisen. It seems likely, however, that the case may go to the Arbitration Court, and cost the ratepayers of Hobart hundreds of pounds. In any case the hearing cannot take place for many months, and in the meantime, as the *Mercury* remarks, the efficiency of the service must suffer by reason of the feeling of antagonism which has been created. Clearly a system which makes it possible to create a dispute without the knowledge or consent of the parties concerned must be wrong.

Petrol and Fares.—In consequence of the reduced cost of petrol the United Automobile Services, Limited, are reducing fares on their omnibuses in many parts of the country. Reductions have been made on the omnibuses run by Manchester Corporation. Before the announcement of the drop in the price of fuel, reductions were made on the omnibuses of the Birmingham Corporation.

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CONCENTRATION OF POWER SUPPLY.

RAILWAY INDEPENDENT POWER-STATION PROHIBITED.

The recent decision of the Electricity Commissioners refusing sanction to the South Eastern and Chatham Railway Company to erect a power-station for their suburban lines about to be electrified is of great importance. The railway company will accordingly have to take their electric traction power from a supply company. The judgment is based on a proviso to Section 11 of the Electricity (Supply) Act of 1919, and this in turn is part of the whole scheme of the Act for concentrating the generation of electricity in a limited number of great power-stations and for preventing the multiplication of smaller stations. Section 11 of the Act of 1919 lays it down that it shall not be lawful for any authority, company, or person to establish a new or extend an existing generating station without the consent of the Commissioners. The appended proviso is that in the case of a railway company consent shall not be refused unless it is proved that a joint electricity authority or authorised undertakers are or will be willing and in a position to give the railway company a supply of electricity adequate in quantity and regularity to meet the present and prospective demands of the railway company at a cost not greater than would have been incurred by the railway company in supplying themselves. After an inquiry, concluded early in June, into the application of the South-Eastern and Chatham Company for sanction to erect a generating station, the Commissioners reported in August that they found that there were authorised undertakers willing and able to give the supply by the required date when the lines shall have been electrically equipped, and that such an arrangement would be no disadvantage to the railway company and would be in the public interest. The Commissioners accordingly recommended the railway company to enter into negotiations with the authorised undertakers and to discuss the terms of a firm contract, and they postponed their decision in order to allow this to be done.

The decision now announced by the Commissioners says—

Since August 21 (when the previous announcement was made) renewed offers have been made to the railway company by the West Kent Electric Company, Limited, and the County of London Electric Supply Company, Limited; an offer has also been made by the London Electric Supply Corporation, Limited. On September 8, however, the railway company informed the Commissioners that "the directors had unanimously resolved that no satisfactory agreement with either of the three companies could be arrived at."

The Commissioners have further considered the whole matter, and have decided to refuse their consent to the erection by the railway company of the proposed generating station at Angerstein's Wharf.

Owing to the public importance of the issues directly and indirectly involved, the Commissioners think it desirable to issue a short statement of the reasons for the decision at which they have arrived.

The considerations affecting the application of the railway company fall into three categories as follows—

(*a*) The merits of the railway company's proposal to establish a 25-cycle generating station at Angerstein's Wharf, in relation to the offers made by authorised undertakers to provide the required supply under a contract including indemnity clauses.

(*b*) The relation of the power-station proposal to the railway electrification scheme as a whole, and the attitude of the railway company towards a supply from an outside source.

(*c*) The bearing of the railway company's proposal upon the question of the reorganisation of electricity supply and upon the policy underlying the various schemes contemplated in this connection.

MERITS OF RAILWAY COMPANY'S APPLICATION.

At the public inquiry only outline plans of the proposed station were submitted by the railway company. In the announcement dated August 21 it was pointed out by the Commissioners that—

> "The proposed design, as shown by these plans is, in the Commissioners' opinion, impracticable for a station of an ultimate size of 150,000 KW. The principal technical witness on behalf of the railway company agreed that in any case a complete modification of this design would have to be made. The Commissioners, while of opinion that the site is suitable for a 60,000 KW. station, have considerable doubt as to whether a station of an ultimate capacity of 150,000 KW. can be constructed on this site if the modified sidings giving access to the wharf are retained."

A careful comparison was made by the Commissioners of the estimates submitted by the railway company and of the terms of the offers made at the inquiry by the West Kent Electric Company Limited, and the County of London Electric Supply Company, Limited, to supply the railway company with the required amount of energy. After making certain requisite adjustments in the estimates, the Commissioners came to the conclusion (as previously announced) that—

> " . . . . It has been proved to their satisfaction that there are authorised undertakers willing to give the railway company a supply of electricity adequate in quantity and regularity to meet the present and prospective demands of the railway company at a cost not greater than would have been incurred by the railway company in supplying themselves."

The revised offers made to the railway company since August 21 by the West Kent Company and the County of London Company, and the offer made by the London Electric Supply Corporation, Limited, copies of which have been furnished to the Commissioners by those companies, have been examined by the Commissioners.

The terms contained in the two revised offers are more favourable to the railway company than those previously put forward at the inquiry, and the terms offered by the London Electric Supply Corporation are also favourable to the railway company.

The Commissioners are thus confirmed in their conclusion quoted above.

The question whether any of the undertakers concerned is or will be in a position to give the railway company the requisite supply in accordance with the proviso to Section 11 of the Electricity (Supply) Act 1919, is one in which the discretion of the Commissioners themselves is directly concerned, owing to the fact that the undertakers would require to obtain certain consents from the Commissioners. As the result of investigation of this aspect of the matter, the Commissioners have satisfied themselves that no particular obstacles stand in the way, and that one or other of the undertakers in question will be in a position to give the railway company the necessary supply by the date when the electrification of the suburban lines is expected to be completed, namely, on or before June 30, 1925.

As regards the suitability or otherwise of the possible outside supplies for the purposes of the railway company, two of the offers relate to supplies at a frequency of 25 cycles, and the other offer to a supply at 50 cycles. The railway company, in evidence at the public inquiry, expressed a preference for a 25 cycle supply, but from the technical point of view a supply at 50 cycles is also practicable, owing to the adoption by the railway company of a direct current system of electrification.

On the question of a guarantee to the railway company against loss arising from failure to give a supply by the due date, considerable stress was laid by the railway company upon the extent of the liabilities to be met as from June 30, 1925, in connection with the Government guarantee under the Trade Facilities Act 1921. Moreover, the railway company have since represented that "the directors do not think any existing company could give the necessary security, nor do they think it would be possible to obtain a guarantee from a responsible institution which could possibly cover the many unforeseen difficulties that might arise."

Two of the offers made to the railway company are supported by letters from one of the leading banks in the country, stating that the bank would be quite prepared to give a guarantee subject to the form thereof being satisfactory, and in the other case the company undertake to satisfy the railway company as to the guarantee of payment of penalties. The Commissioners have not been informed of the reasons why the proposed indemnity clauses and bankers' guarantees have not been accepted by the railway company as satisfactory bases on which to negotiate. In this connection the Commissioners understand that the Trade Facilities Act Advisory Committee would be willing to adopt an arrangement the effect of which would be that in the event of the supply of electricity not being available by June 30, 1925, the obligation of the authorised undertakers concerned (such undertakers being a company of standing) would be substituted for that of the railway company in respect of loan charges during the period of default.

The Commissioners are satisfied that no greater risks would be run by the railway company in taking an outside supply than in proceeding with their own station.

Moreover, by taking an outside supply the railway company would be relieved from incurring capital expenditure amounting to over £1,000,000, and would also have the advantage of an annual saving in the cost of energy which the Commissioners are satisfied is possible under the offers made to the railway company.

RELATION OF POWER-STATION PROPOSAL TO RAILWAY ELECTRIFICATION SCHEME.

The evidence given at the public inquiry made it clear that the railway company first approached the Trade Facilities Act Advisory Committee for a Government guarantee in respect of the railway electrification scheme only, and at that date contemplated that the necessary energy would be taken from an outside source. In the first instance, therefore, the power-station was not regarded by the

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railway company as an essential feature of their electrification scheme, and it was admitted in evidence that on technical grounds alone there was no objection to an outside supply.

The Commissioners are satisfied that the electrification scheme could be carried out without detriment to the railway company if reliance were placed upon a supply of energy from an outside source, and that the construction of a power-station by the railway company is not essential to the scheme.

The cases of the North Eastern Railway and the London, Brighton and South Coast Railway afford practical examples of dependence upon outside supplies of energy for railway traction purposes. The evidence given on behalf of the latter railway at the public inquiry was to the effect that the supply taken from an outside source (i.e., from the London Electric Supply Corporation, Limited) " had been perfectly satisfactory."

With regard to the position of the Government guarantee to the railway company under the Trade Facilities Act 1921, in respect of the electrification scheme, the evidence given at the public inquiry made it clear that the Trade Facilities Act Advisory Committee foresee no difficulty or delay in adjusting the Government guarantee to cover the railway electrification scheme only, subject to a satisfactory assurance from the Commissioners that the supply of energy required by the railway company will be forthcoming when required.

Having regard, therefore, to the evidence given on behalf of the Trade Facilities Act Advisory Committee, to the fact that the Commissioners are satisfied that the conditions as to an outside supply laid down in Section 11 of the Act of 1919 can and will be fulfilled, and to the further fact that the Commissioners are prepared so to advise the Trade Facilities Act Advisory Committee, the only conclusion possible to the Commissioners is that the question of the Government guarantee need be no obstacle in the way of proceeding with the railway electrification scheme, apart altogether from the proposed power-station.

Railway Company's Proposal in Relation to the Reorganisation of Electricity Supply.

The Commissioners have considered the bearing of the railway company's proposal upon the question of the reorganisation of electricity supply, and on the policy underlying the various schemes contemplated in this connection, including the scheme for the London and Home Counties Electricity District.

The policy of reorganisation advocated by the Electric Power Supply Committee of the Board of Trade in 1918, and endorsed by Parliament when the Electricity (Supply) Act 1919 was enacted, provided—

(*a*) For superseding the system which had resulted in the construction of a multiplicity of generating stations of all kinds for the needs of particular areas or bodies, and had led to the adoption of a multiplicity of unco-ordinated systems of supply and of a variety of frequencies, rendering an interchange of energy between adjacent stations or areas oftentimes financially or technically impracticable.

(*b*) For bringing about the centralisation of the generation of electricity for all purposes in large districts technically suitable for the economical generation and distribution of electricity.

Furthermore, the Electric Power Supply Committee expressed the opinion that the supply to railways, tramways or other public utility concerns should be combined with that to other consumers of power, and pointed out that " the importance of combining the supply to railways, tramways and other classes of consumer is beyond doubt, and we believe that each of them will benefit thereby. Combination will also save duplication of capital expenditure on reserve generating plant which would otherwise be necessary." Evidence as to the benefits to be secured by combining railway supplies with other classes of supply was given before that Committee by experienced railway engineers (Report of Electric Power Supply Committee, Cd. 9062, 1918, p. 9).

At the inquiry held by the Commissioners in June and July 1921, into the schemes submitted to them for the reorganisation of electricity supply in the London and Home Counties District, it was stated by Counsel on behalf of certain of the railway companies that—

> " I wish again to make it perfectly clear that the railway companies have no predilection for spending money on the erection of generating stations, but they have come to this inquiry with perfectly open minds and with a hope that the result of this inquiry may be to show that they can buy their electricity as cheaply or cheaper than they can generate it themselves; and if that is the result of the inquiry, if they could be satisfied that they could buy more cheaply than they could generate at, I can say whole-heartedly on behalf of my clients that no one will be more pleased than they will be."

The problem involved in the reorganisation of the supply of electricity in Greater London is one of great magnitude and complexity, and, as is well known, the question has been under consideration since 1905 or earlier, and has formed the subject of a number of Bills before Parliament. The position in 1918 was referred to by the Electric Power Supply Committee as follows—

> " In London, for example, there are seven railway and tramway systems which generate energy for the purposes of traction at differing frequencies—one at 50, two at 33⅓, and four at 25—thus rendering exchange of electricity between them impracticable except at the great expense involved in converting it. Again, there are in the area of Greater London 70 authorised undertakers who supply electricity to the public, and own some 70 generating stations, with 50 different types of system, 10 different frequencies, and 20 different voltages."

The pooling of the railway company's supply and that of other classes of consumers, would constitute an important contribution towards the centralisation of generation in Greater London, and the advantages due to saving in capital expenditure, increased efficiency (and hence lower cost) of generation, and enhanced reliability of supply consequent upon the eventual inter-connection of the principal stations forming the centralised system, would be to the benefit not only of the railway company, but also of other classes of consumers supplied from the central system. To these advantages must be added the national gain by the saving in fuel consumption.

The proposal of the railway company at this juncture to erect their own generating station, thereby involving the foregoing of all the benefits to be derived from the pooling of supplies and the centralisation of generation for all purposes, is not only contrary to the views to which railway engineers and railway companies have expressed their adherence, but is in direct conflict with the fundamental basis upon which the reorganisation of electricity supply must proceed.

Unless it were proved to their complete satisfaction that no alternative was possible, it is clear that the Commissioners could not, with proper regard to their statutory duties, sanction in the present case a course of action which would be prejudicial to the reorganisation of supply in Greater London, and probably in other districts also.

Thus the considerations bearing upon policy and the reorganisation of supply only serve to strengthen the conclusion of the Commissioners that consent to the railway company's application ought not to be given.

A NEW PECKHAM CATALOGUE.

A profusely illustrated catalogue which has recently been issued by the Peckham Truck and Engineering Company, Limited, of Audrey House, Ely Place, London, E.C., should find a place on the reference shelves of every tramway manager and engineer. Although the Peckham truck is well known, it is useful to have at hand particulars in regard to the trucks in service in such cities as Edinburgh, Leeds, Newcastle, Sheffield, etc. Incidentally, the series of illustrations of cars mounted on Peckham trucks serves to show the type of cars that have been more or less standardised in various towns. The catalogue, which has an attractive cover and is well printed on art paper, includes also leaflets on the Thomas Non-Automatic Brake Adjuster, the Thomas Ratchet Locking Device, the Eureka Track Brake, the Rayner " Kleencar " Seat, and other devices that are in constant requisition by tramway engineers. The Peckham Truck and Engineering Company have also produced an excellent model of the Peckham gear designed to make a useful inkstand and pen rack. The company will be glad to send one of these to any tramway manager or engineer on application.

" Safety First " on the G.W.R.—The Great Western Railway Company are distributing to their employees a pocket token which on one side bears the inscription, " Charm against accidents. Is it safe ? " and on the reverse, " In every action ask yourself—Is it safe ? This will disclose unseen dangers, inspire forethought, induce care, and prevent accidents." The company's " safety first " campaign has been very successful. The number of personal injuries among the company's staff has fallen more than 50 per cent. since the introduction of the campaign.

Speeding Up on the " Underground."—With October the London Underground Railway Companies have inaugurated a further speeding up of their train services. Several sections of the lines have been re-signalled, and more rolling stock has been acquired, thus enabling great improvements to be made. During normal hours of the day train speeds will be increased so as to reduce the time of journeys between the centre and suburbs by from one to three minutes. Additional trains are also being run during these hours, and further non-stop trains will be added. During the busy hours trains will be lengthened, and for the benefit of theatre-goers late trains will be reintroduced, starting from central points after half-past twelve o'clock.

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FINANCIAL REPORTS AND MEETINGS.

UNDERFEED STOKER COMPANY announce an interim dividend of 7½ per cent., tax free.

BABCOCK AND WILCOX, LTD., have announced an interim dividend of 8 per cent., free of tax (last year 7 per cent.).

TRACTION POWER SECURITIES.—An interim dividend of 3s. 6d. per share has been announced on the ordinary shares.

BRAZILIAN TRACTION, LIGHT AND POWER CO. have declared a dividend of 1 per cent. on the ordinary stock, payable on December 1.

BRISBANE ELECTRIC TRAMWAYS INVESTMENT CO. LTD., announce an interim dividend at the rate of 8 per cent. per annum, free of tax, on ordinary shares for half-year.

CITY OF BUENOS AYRES TRAMWAYS COMPANY (1904).—A dividend of 1s. 3d. per share, being at 5 per cent. per annum, less tax, for three months ended September 30, 1922, has been declared.

UNITED ELECTRIC TRAMWAYS COMPANY OF CARACAS.—Net revenue for year ended June 30, 1922, was £18,129. Adding balance forward, £14,852, less excess profits duty and corporation tax, £5,503, disposable balance is £27,477 A dividend of 10 per cent. less tax, leaving £10,477 to be carried forward, subject to corporation tax, has been recommended.

DUNDEE, BROUGHTY FERRY AND DISTRICT TRAMWAYS COMPANY, LIMITED, report a gross profit for the year ended July 31, 1922, of £5,517, including £474 brought in. After deduction of interest on debenture stock, and an interim dividend on the preference shares for the half year, absorbing £2,234, there is a balance of £3,282. A dividend on the ordinary shares at the rate of 7 per cent., less tax, carrying £500 to reserve and £244 forward, has been declared.

BANN SYNDICATE, LTD., has been registered as a private company with a nominal capital of £10,000 in £1 shares, to promote a Bill or Bills in the Parliament of Northern Ireland or any other seat of Parliament, granting permission for the supply of electrical energy and giving authority and directions to promote and assist in promoting railways, tramways, hydraulic works, electric and other lighting works, or any of them, and the business of supply connected therewith, etc.

AYR CORPORATION TRAMWAYS.—The annual report for the year ended May 25, 1922, states that the net result of the year's working, after meeting capital charges and setting aside £2,597 to depreciation and renewals fund, is a credit balance of £1,261, which it is proposed to place to reserve fund, which was depleted to meet a deficiency the previous year. Traffic revenue was £35,568, as compared with £38,365 in the previous year, but owing to working expenses being considerably less, £27,464, as compared with £34,354, there was an increase of a little over £4,000 shown by the gross profit £9,374.

NEW SOUTH WALES GOVERNMENT TRAMWAYS.—The report of the Commissioners of the New South Wales Government Railways and Tramways for the year ended June 30, 1922, states that the total route length of tramways now amounts to 229¼ miles, and the total track miles to 366¾. The total capital expenditure amounts to £9,505,732. The total earnings amounted to £3,610,135, an increase of £138,397 over the previous year, while the working expenses were £3,015,616, or an increase of £72,364. The working expenses were 83·53 per cent. of the earnings. The average number of employees engaged on the tramways during the year was 9,344.

CHOCOLATE EXPRESS OMNIBUS CO. LTD.—The London omnibus service which was recently started on a small scale has now been taken over by the Chocolate Express Omnibus Co. Ltd., which has been registered with a nominal capital of £15,000 in £1 shares. The first directors are Messrs. A. G. Partridge (chairman), 36 Gayville Road, S.W.; D. F. Jermyn, 5 Crab Tree Lane, Fulham, S.W.; A. S. Griffin, 32 Crab Tree Lane, Fulham, S.W. The minimum cash subscription is seven shares; qualification £200; remuneration, £50 each per annum (chairman, £100). No notice of the situation of registered office was filed at time of incorporation.

WALLASEY MOTOR OMNIBUSES.—In the annual report of the Wallasey Corporation Tramways for the year ended March 31, 1922 it appears that the receipts per motor omnibus-mile averaged 23·04d., the receipts per passenger 2·89d., and the passengers 7·97. For the previous year the corresponding figures were 18d., 2·62d., and 6·86. The number of passengers carried by the omnibuses during the year was 1,012,731. The total receipts for the omnibuses amounted to £12,212, and the working expenses to £9,464, leaving a gross balance of £2,748. Interest on capital required £520, £1,000 was placed to depreciation, and £1,228 was carried to the credit of the tramways account as net revenue.

HURST, NELSON AND CO. LTD.—Accounts to July 15 show gross profit, after usual deductions, of £106,575. Deducting depreciation, £23,895, and including £17,057 brought in, the net total was £100,186 The directors recommend preference dividend to November 11, less tax, £6,000; to reserve for similar dividend on May 15, £6,000; to general reserve account, £20,000, thereby raising it to £90,000; to payment on November 11 of dividend on ordinary share capital at 2s. per share, free of tax, £20,000; to payment of bonus of 1s. free of tax, £10,000; to reserve for payment of interim dividend, free of tax, on May 15, on ordinary share capital, £19,000; to special reserve for preference share dividends, £5,000; to special reserve account for equalisation of dividends on ordinary share capital, £5,000; to be carried forward, £18,186.

WALLASEY CORPORATION TRAMWAYS.—The report for the year ended March 31, 1922, showed a total income of £144,927, working expenses amounted to £114,695, leaving a gross balance of £30,232. Adding surplus dividends, £226, motor omnibus profit, £1,228, balance brought forward, £2,285, there is an available balance of £33,971. After deducting balance (April 1, 1921), £5,029; interest, £7,914; sinking fund, £5,265; and instalments of loans, £2,261; and placing £5,000 to depreciation and renewals fund, there was a balance of £8,500, which was allocated to the borough fund in aid of the rates. The ratio of expenses to total revenue was 79·1 per cent. The average working expenses amounted to 19·95d. per car mile, and the total revenue was 25·20d. The average consumption of units per car-mile was 1·76. The Corporation has 78 cars and works 20 miles of track.

CITY OF LEICESTER TRAMWAYS.—The report for the year ended December 31, 1921, shows that the total revenue for the year 1921 amounted to £349,280, a decrease of £170. The passengers carried numbered 49,727,936, a decrease of 7,772,357, and the cars ran 3,988,088 miles, a decrease of 230,138 on the previous year. The total receipts averaged 21·019d. per mile, against 19·882d. last year, an increase of 1·137d. per car-mile. The working expenses amounted to £320,619, an increase of £12,854. This was chiefly due to high prices of materials. The revenue during the coal strike, April 1 to July 4, was very considerably reduced. The gross profits amounted to £28,661, against £41,687 in the previous year, and interest, sinking fund, income-tax, and bank interest were £49,391, against £43,771, an increase of £5,620, leaving a net deficit of £20,730. The net loss owing to the coal strike is estimated at £20,000.

NOTTINGHAM CORPORATION TRAMWAYS.—The annual report for the year ended March 31, 1922, shows a loss of £372. The reserve fund, to which, it is stated, nothing was placed either for this or for the previous year, has gone down from £118,111 in 1919 to £50,092. Traffic receipts from the tramway service amounted to £352,032, which, with sundry receipts of £2,933, made a total of £354,965, a decrease of £43,948 compared with the previous year. Working expenses amounted to £286,856, a decrease of £50,771, leaving a gross profit on working of £68,109. Receipts from motor omnibuses totalled £6,914, the amount being considerably increased owing to the abnormally heavy traffic carried during the suspension, owing to the coal stoppage, of the tramway services, when the omnibuses were diverted to busy sections of the tramway routes. The operating expenses were £6,249, leaving £665 for interest, sinking fund and depreciation charges. The fare-paying passengers carried on all services amounted to 55,382,555, a decrease of 6,783,818 compared with the previous year.

KEIGHLEY CORPORATION TRAMWAYS.—The annual report and statement of accounts shows that for the year ended March 31, 1922 there was a net loss on the tramways amounting to £4,634 and on the railless vehicles of £5,368. On the working of the petrol omnibuses, which were in operation from December 3 to March 31, there is a balance of £107 to be carried to net revenue account. There is a loss of £2,179 on revenue account, and after allowing for sinking fund transfers, interest on loans, etc., the net loss amounts to £4,634, the revenue showing a decrease of 4·91 per cent., being £18,553, against £19,512 last year. The account for power showed an increase of £477, although the mileage was 3,833 less than in the previous year. The cost of repairing the permanent way had been £4,731, which represented 5·18d. per revenue mile run. With regard to the railless vehicles, the receipts amounted to £4,840 against £3,337 in the previous year. The power expenses had increased by £245, which was accounted for by an increased mileage of 12,965, and also by an increased charge. The receipts on the motor omnibuses amounted to £1,610, an average of 20·838d. per omnibus mile, while the working expenses, including the sum of £100 paid to Leyland Motors, Ltd., as depreciation on the omnibus returned to them, totalled £1,503, an average of 19·455d. per car-mile. The receipts on the omnibuses had gradually increased, and for the first five months of the current year a consistent income of 26·5d. per omnibus-mile had been maintained, this being considered most satisfactory. On the tramways the passengers carried showed a decrease of 5·74 per cent., and the mileage had decreased by 1·67 per cent. On the railless vehicles the passengers had increased by 27·55 per cent., and the mileage by 30·07 per cent.

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TRAMWAY AND LIGHT RAILWAY NOTES.

ABERDEEN.

CONTINUING EMPLOYMENT—CAR REMODELLING.

The Tramways Committee have decided to augment the service, as was done last year, to provide continued employment for twenty-two men who were engaged for the heavier traffic of the summer months. A programme of alterations to cars will, it is anticipated, give employment in the workshops for twelve months, the Committee having recommended that twenty-three cars of the pay-as-you-enter type shall be altered into the new standard type at an approximate cost of £3,450.

BELFAST.

EXTENSION SCHEME—LOCAL TENDER PREFERRED.

The Tramways Committee are proposing to make an arrangement with the Harbour Commissioners for the extension of Queen's Road tramways and for the laying of a tramway line on the Dufferin Road. It is also intended to run omnibuses in the city and within a ten-mile radius of the city boundaries. In regard to three tenders received for the reconstruction of the second section of the tramway track, the Council preferred to accept the higher priced tender of James Hogg and Son, Limited, of Belfast, as against that of the Foundation Company, of Kingsway, London, which the Tramways Committee had recommended.

BLACKPOOL.

OMNIBUSES NO REMEDY.

Owing to traffic congestion a suggestion that the single tramway track from the Central Station to St. Annes Road should be dispensed with and the cars replaced by motor omnibuses has been before the Tramways Committee. The general manager, Mr. C. Furness, reported that to provide omnibuses to give the same carrying capacity as the cars would call for at least double the number of vehicles, and in addition working expenses would be correspondingly increased. In his opinion the adoption of such a course would add to the congestion. Financially the effect would be to impose additional expenses by the provision of a new omnibus depot. The cost of this would be £20,000, whilst the new vehicles would cost £60,000. He believed that a proper solution could only be determined by a conference with the railway company with a view to a joint scheme being prepared for making Waterloo Road Station the railway terminus, and converting the railway from Bloomfield Road to Central Station into a new arterial road.

BOURNEMOUTH.

The Town Council have referred to the Tramways Committee a letter from the Ministry of Transport calling attention to the fact that the Bournemouth Corporation Tramways (Temporary Increase of Charges) Order 1921, would not under any circumstances have effect after February 15, 1923, and stating that if the Council after full consideration felt compelled to seek power to levy temporarily after that date any charges in excess of the permanent statutory maxima applicable to the undertaking, it would be necessary to apply to the Ministry for an order. The general manager, Mr. I. Bulfin, expressed the opinion that it might not be necessary to apply for a further order.

BRADFORD.

RAILLESS CARS.

Application is to be made for powers to run railless trolley cars on new routes in various parts of the city. Five principal routes have been mentioned as suitable. Three are partly within and partly without the city, and one is of interest to Leeds as well as to Bradford, seeing that it would provide for the linking up of Greengates (Bradford) terminus with the Guiseley-Leeds tramway route, via the Harrogate and Apperley roads. It is stated that the cost is not likely to be excessive seeing that in most cases the routes are the same as the existing tramway routes.

BRISTOL.

TRAMWAY COMPANY TO CARRY ON.

The City Council have resolved by 62 votes to 21 not to exercise their option of acquiring the tramway undertaking of the Bristol Tramways and Carriage Company within the city. In 1914 the Council decided to purchase, but owing to changed circumstances the decision has now been reversed, and the option lapses for seven years.

CARDIFF.

HALF-FARES FOR CHILDREN.

The City Council have agreed that all children between the ages of three years and fourteen years of age be allowed to travel on the tramway cars and omnibuses at half-fare, with a minimum fare of 1d. and a fare of 1d. for the 2½d. stages; the privilege to be extended to students up to the age of seventeen years attending secondary schools, on production of birth certificate.

CROYDON.

THE CORPORATION TRAMWAYS POSITION.

The tramway undertaking of the Corporation is at present in a difficult position, with a debt of over £100,000 and annual loan charges of about £13,000 to meet. The abandonment of the enterprise has even been suggested. The Town Council, however, have decided upon the spending of £300,000 upon track reconstruction and the provision of new rolling stock, and the arrangement of a through service to the Embankment by means of the London County Council system.

GLASGOW.

WAGES REDUCTION—WORK FOR UNEMPLOYED—BARRHEAD SERVICE.

A reduction of 3s. a week instead of 6s., as originally proposed, in the wages of the Corporation tramway employees has been effected by agreement. Several extension schemes are being proceeded with in order to provide work for the unemployed. The Corporation in connection with their acquisition of the system of the Paisley District Tramways Company propose the running of a through service of cars between Glasgow and Barrhead, with a suitable service to meet the convenience of workmen. The fares and fare stages will be similar to those in operation in Glasgow. It is intended as soon as practicable to double the whole line, nor only in Barrhead, but between Barrhead and Paisley.

HULL.

ENGLISH OR FOREIGN RAILS—COSTS CUTS.

The question of whether to accept a tender for German-made rails at £9,450, or one for English-made rails at £11,750, came before the City Council on a recommendation of the Tramways Committee that Steel, Peech and Tozer, Limited, of Sheffield, should be communicated with to ascertain if they were prepared to reduce their price, and in the event of their agreeing to a reduction their tender should be accepted. An amendment to accept the lowest tender found only eighteen supporters. A reference back, with instructions to re-advertise the contract on terms excluding foreign-made goods was suggested, but eventually it was agreed that the committee should take the matter back for reconsideration. A special committee of the Corporation who have been investigating the conditions of local administration recommended the reduction of the yearly expenditure by approximately £100,000, including a suggested cut of £27,100 on the tramways by means of reduction of staff in repair sheds, reduction of material, and saving on track repair.

LIVERPOOL.

PENNY FARES AGAIN—SHELTERS.

Penny fares have been reintroduced, the twopenny stages on the Corporation tramways having been divided into three penny stages. It has been decided to erect passenger shelters at the Old Haymarket, Clayton Square, and opposite the Adelphi Hotel, and similar conveniences will probably be provided in other parts of the city.

LONDON.

SAVING ON WAGES—FOREIGN TENDERS LIMIT.

The London County Council is applying the wages agreement of the Joint Council to the tramways department, the saving being estimated at £62,000 for the present financial year, and about £124,000 in subsequent years, according to the present establishment. It has been decided to remove the names of foreign firms from the Council's list of firms to be invited to tender for the supply of stores, and to invite tenders from foreign firms only when it is expedient. The list of firms to be invited to tender for the supply of stores and for general maintenance work as and when occasion has demanded has been revised, and on September 30, 1922, the total number was 356, exclusive of those for special stores or work not included in the ordinary schedules. The number of tenders and quotations received and opened during the quarter was 635. The Highways Committee are considering the question of extending the tramways over Southwark Bridge. In the opinion of Dr. R. L. Guthrie, East London coroner, expressed at an inquest, all overtaking traffic should be compelled to stop when tramway cars are setting down passengers, It has been suggested that the tramway systems of the London County Council and the Leyton Urban Council should be connected by means of a road recently constructed over the Hackney Marshes.

MIDDLESBROUGH.

MEN INSTEAD OF WOMEN.

The Tramways Committee, having received a deputation from the Transport and General Workers' Union regarding the dismissal of six tramway conductors, all of whom, it was stated, were married and ex-service men, while eight women conductors were retained, decided that the services of the women, with two exceptions, be dispensed with, and that the men be reinstated,

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MUSSELBURGH.

LIABILITY FOR ALTERATIONS.

Negotiations have passed between the Town Council and the Musselburgh and District Electric Light and Traction Company in regard to liability for making the alterations to the electric car and lighting equipment rendered necessary by certain street improvements. The company have declined an offer of compensation. They have maintained that the Town Council are liable for the whole cost, estimated at £239, and would be responsible for any accidents that might occur during the operations. They have asked 10 per cent. for superintending the work. It has been stated that at a conference between the parties the tramway representatives adhered to their position, although suggestions made resulted in a reduction of the cost.

NOTTINGHAM.

VEHICLES PASSING CARS—SHELTERS.

The Watch Committee have decided that they can take no action to obtain legislation for the further control of motor traffic passing stationary tramway cars. The Nottingham Trades Council had suggested that power should be sought to prevent vehicles passing cars on the near side when passengers were alighting or entering. The Chief Constable reported that, although many towns had sought such powers during the past two years, only Glasgow had obtained them. The Tramways Committee are inquiring as to the most suitable places for the erection of shelters on the tramway system. Several shelters have been built, but the intention is now to consider the whole problem.

NEWCASTLE-ON-TYNE.

THE WAGES CRISIS.

The proposed reduction of the wages of the Corporation tramway employees has been discussed between a sub-committee of the Transport and Electricity Committee and representatives of the Transport and General Workers' Union. In regard to the senior men's pay a cut was proposed of 10s. a week—4s. in November, 3s. in December, and 3s. in January—which would leave the wages 70 per cent. above pre-war rates. In the case of junior men and assistant conductors, 18-21 years of age, it was proposed to reduce the pay from £2 13s. 6d. to £1 17s. 6d. by three instalments, leaving a 50 per cent increase compared with pre-war conditions. It was pointed out that when the reductions had been made the men would be on an equality with many of the skilled workmen in the engineering trades who have served an apprenticeship. Mr. N. Bradwell, national organiser for the Transport and General Workers' Union, has stated that the dispute arose from the desire of the committee for a reduction in wages of 10s. per week for adult, and 6s. for junior workers, without any provision being made for the future regulation of wages. The men were prepared to accept a reduction of 4s. per week, in accordance with the agreement arrived at by the Joint Council for the tramway industry (of which the Newcastle tramways department is not a member). The employees at a mass meeting reaffirmed their decision in favour of the national agreement and their intention to oppose to the utmost the 10s. cut. The sub-committee adhered to the reduction proposals, and submitted them for approval to the Transport and Electricity Committee, by whom they were confirmed. It was, however, agreed to throw the responsibility of deciding on to the City Council by presenting a report recommending the reduction, and this will be discussed at a meeting of the Council during the third week in November. The employees had threatened to strike if the reductions were enforced, and trouble was thus avoided during the municipal elections.

PLYMOUTH.

NEW CARS FOR OLD.

An interesting piece of car remodelling is being done at the Corporation tramway depot. The vehicles, which number sixteen, have the same bodies as those of certain cars which were run by the Plymouth, Stonehouse and Devonport Tramways Company, and known as "the green cars." They are being reconstructed by the provision of a new truck for running on hilly routes, and two are already in use. They are being equipped with a screen for the protection of the motorman, and with driving apparatus at one end only, which allows of six more passengers being carried, but makes it necessary to employ them on circular routes only.

SALFORD.

WAGE CUTS SUSPENDED—TROLLEY BOYS.

The suggested reduction of 5s. 6d. a week which would have affected engineers in the employ of the Corporation has been suspended, and the case has been referred to the consideration of the Special Staffs Committee. A deputation of the employees to the Tramways Committee urged that if the cut were made skilled workmen would find themselves in a less favourable position as compared with semi-skilled workers and labourers who enjoyed other wage awards. It was also argued that, while private employers had cited slack trade as the cause of wage reductions, municipalities could not claim that their revenue had diminished in anything like the same proportion. The Tramways Committee are dispensing with trolley boys, except where, in the opinion of the traffic superintendent, they are absolutely necessary. In these cases the conductor of the car will be given the assistance of a boy at the busy hours.

SHEFFIELD.

HOURS OF WORK—SUCCESSFUL WAR CLAIM.

There is a demand among the tramway employees for the resumption of the 44-hour week. Under present conditions they are paid for time actually worked, which they say is a very unsatisfactory arrangement, as they cover long "spread-overs" and at the end of the week find themselves receiving only a comparatively small wage. The claim of the Corporation against the Government for compensation for the use of their tramway depot has been settled by the War Compensation Court on the basis of an estimated fair rent for the occupation of the depot. Subject to the Court's approval the War Office agreed to accept an award at the rate of £830 a year, the amount of the claim after deducting the rates, the period of user covered being from August 21, 1917, to May 10, 1919—one year 263 days. The Corporation were awarded the agreed sum of £1,430.

STOKE-ON-TRENT.

FUTURE OF LOCAL TRAMWAYS.

It is understood that the Potteries Electric Traction Company propose to promote a Bill in Parliament to obtain the renewal of their working of the tramways in Stoke-on-Trent and district for thirty years, but that they would be willing to accept as an alternative the leasing of the system to the Stoke-on-Trent Corporation as distinct from purchase, which was defeated a few years ago.

SUNDERLAND.

THE WAGES QUESTION.

The Corporation tramway employees are in favour of accepting the terms as to wages arranged by the Joint Council, and have put forward similar terms as counter proposals to the proposals of the Tramways Committee, who, it will be remembered, have seceded from the Joint Council.

SWANSEA.

PROJECTED IMPROVEMENTS.

It is understood that the Swansea Improvements and Tramways Company contemplate spending £40,000 on renewing and doubling portions of track and the conversion of five more cars into double-deckers at a cost of £2,000.

END OF THE WAGES CONTROVERSY.

The controversy about wages reductions in the tramways industry, as was anticipated in our issue of October 12, resulted in a peaceful conclusion. The voting in the ballot of the Transport and General Workers' Union on the terms of settlement provisionally agreed at the Joint Council was—for acceptance, 22,436; against, 10,541; majority, 11,895. It was stated that 55 per cent. of the members who were eligible had voted, which was considered a good percentage. The National Trade Group Committee of the Transport and General Workers' Union instructed the secretary to sign the agreement in conjunction with the representatives of the tramway employers' organisations. Accordingly on October 10 the agreement received the signatures of Mr. J. Beckett and Mr. A. de Turkheim, representing the employers' side of the Joint Council, and Mr. J. Cliff for the employees' side.

SOUTH AFRICAN RAILWAYS ELECTRIFICATION.

In connection with the electrification of a portion of the line between Durban and Johannesburg, large orders have been secured for this country against strong competition. Included in the contracts placed is an order for the machinery for the sub-stations to be located between Pietermaritzburg and Glencoe, a distance of approximately 175 miles. This order, covering twenty-one 2,000 KW. motor generator sets for 3,000 volts D.C. service, together with switchgear, automatic control gear, auxiliary transformers, etc., has been secured by the British Thomson-Houston Company, Limited, and will be manufactured in England at their Rugby and Willesden works, the approximate value being £400,000.

The consulting engineers to the South African Railways and Harbours Administration in connection with this work are Messrs. Merz and McLellan, of London and Newcastle.

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PERSONAL.

Mr. G. H. Pickles, borough surveyor of Burnley, has resigned.

Mr. J. W. Galloway has resigned the position of tramways engineer to the Halifax Corporation.

Mr. W. F. Haldane has been appointed branch manager in Dublin for the British Thomson-Houston Co. Ltd.

Sir Frederick Banbury, M.P., has declined nomination to the board of directors for the Eastern Group of Railways.

Mr. T. Roles, city electrical engineer of Bradford, has been granted leave of absence until January 1, 1923, to recuperate his health.

Mr. W. W. Clark will retain the managership of the Luton tramways when the Corporation takes over the undertaking in February next.

Mr. R. D. Spurr, of Bradford, has been appointed chief assistant engineer at the Sunderland municipal electricity works at a salary of £608 per annum.

Mr. J. Hagen has been appointed by Edinburgh Corporation as boiler house superintendent at the new power station at Portobello, at a salary of £400 per annum.

Mr. T. A. Taylor, lately assistant engineer to the Burma Electric Tramway and Lighting Company, has been appointed mains assistant by Fulham Electricity Committee.

Mr. A. Foden, having been appointed engineer in charge of the Eccles Borough Electricity Department, has resigned his post with the Metropolitan-Vickers Electrical Co. Ltd.

Mr. E. Cross, borough electrical engineer and tramway manager of Rotherham Corporation, has been elected president of the Rotherham Technical Institute Engineering Society.

Lord Claud Hamilton, after fifty years' association with railway management, has intimated his intention of retiring from his directorship of the Eastern Group of Railways at the end of the year.

Mr. F. A. Fitzpayne, deputy tramway manager, and **Mr. R. McLeod,** traffic superintendent of the Edinburgh Corporation Tramways, have received increases of salary to £650 and £550 respectively.

Major H. Richardson, who has resigned his position as city electrical and tramways engineer of Dundee, has been presented with a handsome dressing case by the chief officials of the Corporation.

Mr. W. M. Rogerson, borough electrical engineer of Halifax, has been appointed temporary chairman of the Engineers' Committee of the Conference of Authorities in connection with the Aire and Calder electricity district.

Mr. Walter Moon, clerk and solicitor to the Metropolitan Water Board, who has been appointed to the town clerkship of Liverpool, at a salary of £3,300 a year, was formerly assistant solicitor to the Metropolitan Railway Company.

Sir Eric Geddes has been unanimously nominated by the Grand Council as president of the Federation of British Industries during the coming year. The nomination will be submitted at the annual meeting of members to be held shortly.

Mr. A. A. Watkins has been appointed chief assistant engineer (not chief engineer, as stated in our issue of July 13 last) to Mr. W. G. T. Goodman, chief engineer and general manager of the Municipal Tramways Trust, of Adelaide.

Mr. B. D. F. Docker has been elected a director of the Anglo-Argentine Tramways Company, to fill the vacancy caused by the death of Mr. W. F. Hamilton, K.C. Mr. Docker is a director of the Metropolitan Carriage, Wagon and Finance Co. Ltd.

Sir George Beharrel, D.S.O., has resigned his position as Director-General of the Finance and Statistical Department, Ministry of Transport, and has taken up an important position with the Dunlop Rubber Co. Ltd., of which Sir Eric Geddes was recently appointed a director.

Mr. A. F. Kellett, permanent way engineer to the Sheffield Corporation Tramways, has joined the staff of the Equipment and Engineering Co. as representative in the Leeds area. Mr. Kellett, who was formerly assistant permanent way engineer to the Bradford Corporation Tramways, is a member of the Institution of Municipal and County Engineers, and an associate member of the Institution of Mechanical Engineers.

Sir Henry Thornton, general manager of the Great Eastern Railway, has been appointed chief of the Canadian National Railway, at a salary of 50,000 dollars a year, and takes up the position before the end of the month. Sir Henry entertained the staff of the Great Eastern Railway at a farewell dinner at the Liverpool Street Hotel on Friday, October 27. Sir Henry was accompanied by Lady Thornton and Miss Thornton, and they were all recipients of gifts subscribed for by the Great Eastern staff. Sir Henry was afterwards presented with a gold medallion from the National Union of Railwaymen by Mr. J. H. Thomas, M.P., who said that Sir Henry Thornton had proved himself to be one of the best general managers this country had ever known.

CONTRACTS AND ORDERS.

Callender's Cable and Construction Co. Ltd. are supplying feeder and pilot cables to Doncaster Corporation for £1,499.

Enfield Edison Swan Cable Works' tender for feeder cable at £2,849 has been accepted by Doncaster Corporation.

Sheffield Corporation have accepted the tender of Steel, Peech and Tozer, Ltd., for 650 tons of tramway rails at £10 5s. 6d. per ton.

Holmfirth Urban Council have accepted a tender for alterations to the plant at the electricity works (£3,160) from Johnson and Phillips, Ltd.

Wolverhampton Tramways Committee have recommended the tender of M. A. Boswell for £14,617, for relaying a portion of the tramway track.

The Spearing Boiler Company Limited have been successful in securing the contract for two water tube boilers of 30,000 lbs. each from the Watford Corporation.

Salford Tramways Committee have recommended the tender of the Cargo Fleet Iron Co. Ltd., Middlesbrough, for £2,544 15s. 10d., for 250 tons of steel girder tramway rails, at the price of £10 3s. 7d. per ton.

Metropolitan-Vickers Electrical Co. Ltd. have received an order for electrical equipments for the new rolling stock of the Piccadilly line of the London Underground Group. The contract amounts to £159,767.

Bournemouth Town Council have accepted tenders for the reconstruction of three sections of track for £31,686 from William Griffiths and Co. Ltd., subject to the Ministry of Transport sanctioning the necessary loan.

Sunderland Corporation have accepted the following tenders—Pirelli General Cable Works and British Insulated and Helsby Cables, Ltd., l.t. cables; W. T. Henley's Telegraph Works Co. Ltd., feeder pillars.

Manchester Corporation have accepted tenders from Walter Scott, Ltd., for steel girder tramway rails; and from Titan Trackwork Co. Ltd., Edgar Allen and Co. Ltd., and Hadfields, Ltd., for portions of special track work.

Auckland City Council are purchasing from the National Electrical and Engineering Company, of Auckland, representing the General Electric Company of America, electrical equipments for ten bogie cars at a price of £11,131.

Bristol Tramways and Carriage Co. Ltd. have received an order from Doncaster Corporation for the supply of their latest type single-deck "Bristol" omnibuses, with separate doors for entrance and exit, and also with smoking compartment.

Glasgow Tramways Committee have accepted tenders as follows—Trolley wire, Thos. Bolton and Sons, Ltd.; m.s. plates for welding, Steel Company of Scotland, Ltd.; insulated bolts, Fleming, Birkby and Goodall, Ltd.; v.i.r. cable, Johnson and Phillips, Ltd.; lead-covered cable, Western Electric Co. Ltd.; iron castings (section pillars), McDowall, Steven and Co. Ltd.

Edinburgh Car Equipment Contract.—The Edinburgh Town Council have accepted the following tenders, as recommended by the Tramways Committee—Hurst, Nelson and Company, Limited, for 96 trucks, at £105 each (the trucks will be of the Peckham pendulum gear type, which the Corporation had previously ordered for 165 cars); Metropolitan-Vickers Electrical Company, Limited, 112 motors at £150 each; the British Thomson-Houston Company, Limited, controllers; and the British Mannesmann Tube Company, Limited, 1-piece poles.

The Brazilian Minister of Transport has authorised the directors of the Central of Brazil State Railway to accept the offer of the General Electric Company, of New York, for the electrification of the railway to the extent of about 53 miles, consisting mostly of suburban lines in the vicinity of Rio de Janeiro. The Central Railway has about 2,000 miles of route, so that this first electrification relates only to a small portion of the system. The total value of the contract is stated to be £2,000,000. Offers were received from the Metropolitan-Vickers Electrical Co. Ltd., and the Westinghouse Electric and Manufacturing Company, of Pittsburg.

Cannock Urban Council have recently obtained an installation for the supply of electricity in their district from a main sub-station, current being obtained in bulk from the Wolverhampton Corporation. The whole of the main sub-station equipment has been supplied and erected by the General Electric Co. Ltd., of Magnet House, Kingsway, London, and Witton, Birmingham, who have acted as main contractors, the transformers having been manufactured by Messrs. Ferranti, Ltd., of Hollinwood, Lancs., as sub-contractors to the General Electric Co. Ltd. The 33,000 volt, 6,600 volt, and 400 volt mains used in connection with the scheme have been supplied and laid by the British Insulated and Helsby Cables, Ltd., Prescot.

London Electric Railway Extension.—A contract has been placed with the Foundation Co. Ltd., Kingsway, London, for the construction of the northern part of the electric railway, which will

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form an extension of the Charing Cross and Hampstead (Tube) Railway from Golders Green to Edgware. The part of the line between Golders Green and Hendon is already under construction, and the new contract is for the part between Hendon and Edgware, a distance of about three miles, the cost to be £258,000. The total length from Golders Green to Edgware is about 4½ miles. The extension, being in the country, will be on the surface. The work under the new contract, which will give employment to a large number of men, is expected to be completed in fourteen months.

The N.K.A. Patent Disc Bearing for Cars.—Nya Nordiska Kullager Aktiebolaget of Gothenburg, Sweden, have submitted tenders for their patent disc bearings to tramway companies in Holland, Argentine, Finland and Japan, and have actually received orders from Holland, Argentine and Finland, as well as an experimental order from Great Britain. Apparently the disc bearings are required for both axle boxes and driving motors. These inquiries are, no doubt, a direct result of the Swedish State Railways placing a substantial order for the patent disc bearings for their railway coaches, since it is certain the order was placed only after extensive investigations and tests. For axle boxes and driving motors the disc bearing is undoubtedly economical, and the manufacturers are confident that sooner or later it will be adopted as one of the standard types. Full particulars can be obtained from Northern Ball Bearings, Ltd., 115 Great Portland Street, London, W.1.

London County Council have adopted the recommendation of the Highways Committee, accepting certain tenders for various requirements for the foundations, etc., required for No. 4 turbo-generator at Greenwich power station. Twelve selected firms tendered at prices ranging from £2,979 to £5,140. The lowest tender, that of J. and C. Bowyer, Ltd., was accepted. The architect's estimate comparable with the tenders was £3,202. As a result of advertisement the following tenders were received for the supply of high-tension switchgear required for the extension and equipment of the central repair depot—Johnson and Phillips, Ltd., £1,070 11s.; Ferguson and Pailin, Ltd., £1,124 18s.; A. Reyrolle and Co. Ltd., £1,530; General Electric Co. Ltd., £1,570 10s.; Park Royal Engineering Works, Ltd., £1,619; British Thomson-Houston Co. Ltd., £1,742 3s.; Switchgear and Cowans, Ltd., £2,145 15s.; Metropolitan-Vickers Electrical Co. Ltd., £2,008; Bertram Thomas, £2,145 15s. The tender of Johnson and Phillips, Ltd,, was accepted. The tender of Holt and Willetts, amounting to £1,838, was accepted for the provision of four electric lifts required for the extension of the central repair depot. Nineteen tenders were received according to specification. The prices ranged from £1,838 to £4,565. The lowest tender, submitted by the Cory Lighterage, Ltd., for the removal and disposal of ashes from Greenwich power-station for periods of six or twelve months from August 1, 1922, was accepted. The price was 2s. 5½d. a cubic yard for a period of six months. The cost of the work during the period covered by the contract was estimated not to exceed £4,000.

PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given in italics.

Applications for Letters Patent.

The number of the patent is given in brackets.

Gearing transmitting drive of vehicle wheels (26,192)—Associated Equipment Company, Limited, and C. K. Edwards.
Brakes for road vehicles (26,075)—British Electrical Federation, Limited, A. Twidle, and E. P. Worsfold.
Motor vehicles (25,871)—C. Heyermans.
Frictional braking gear (26,195)—London General Omnibus Company Limited, G. J. Shave, and O. W. J. Watson.
Rail transport systems (25,971)—G. Lynch.
Brake mechanism for steered wheels of motor vehicles (26,006)—A. Serex.
Brake blocks, etc. (25,820)—R. E. Sharples.
Brakes of motor vehicles (26,093)—F. E. Sheridan.
Collapsible hood for open deck tramcars, etc. (26,188)—H. J. Webber.
Gear changing mechanism for motor vehicles (26,582)—R. H. Barbour.
Bodies of motor vehicles (26,491)—J. A. Anderson.
Safety guards for road vehicles (27,037)—J. B. Campbell.
Change speed gearing for motor vehicles (27,031)—C. H. Caton.
Derailed tram adjuster (27,050)—J. Davies and E. M. White.
Electrically propelled vehicles (27,124)—T. Foster.
Hand grips for standing passengers (27,161)—J. J. Le Clair and G. D. Peters and Company, Limited.
Tramway and railway rails (27,195)—J. G. Longstaff.
Electric traction systems (27,016)—E. M. Munro.
Motor vehicles (26,570)—A. E. Osborn.

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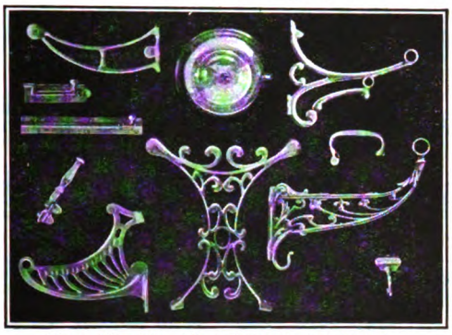

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Route indicators (26,826)—W. Sheppy.
Conductor rails and covers therefor for electric railways, etc. (26,859)—Siluminite Insulator Company, Limited, and F. V. Wythes.
Engineering lubrication systems of motor vehicles (27,160)—L. B. Stedman.
Hydraulic car jack (26,676)—F. Steiner Nachfolger.
Rail bending appliances (26,697)—B. M. Veth.
Clutch and flywheel combination for motor vehicle engines (27,780)—Albion Motor Car Company, Limited, and T. B. Murray.
Motor vehicles (27,312)—Goodyear Tyre and Rubber Company.
Electric current operated controlling mechanism (27,544)—L. B. Hewitt and Metropolitan Electric Tramways, Limited.
Tramway loops and points (27,763)—J. E. Heywood.
Automatic road speed controller for motor vehicles (27,616)—F. A. Laythorpe.
Motor vehicles (27,437)—A. E. S. Seccombe.
Conductor rails for electric railways, etc. (27,295)—Siluminite Insulator Company, Limited, and F. V. Wythes.
Passenger cars (27,340)—W. Voss.
Repairing broken trolley wires of tramways (27,757)—J. W. Waddington.
Lifting jacks (27,462)—H. Wade (*Hydrostatic Jacks, Limited*).
Motor vehicles (27,813)—A. W. Weller and J. F. N. Young.
Chassis for motor vehicles (27,235)—J. Weller.
Grooved tramway rails (28,553)—J. P. Barker.
Lifting jacks (28,458)—W. C. Bilham and H. H. Gelman.
Lifting jacks (28,425 and 28,631)—A. E. Lake.
Transmission and change gear mechanism of motor vehicles (28,461)—F. W. Lanchester.
Lifting jack (28,675)—W. H. W. Proctor.
Fuel consumption meters for motor vehicles (28,141)—F. S. Rippingille.
Lifting jacks (28,565)—W. Stanley.
Brakes for motor vehicles (29,265)—G. Cattaneo.
Life-guards for tramcars, etc. (29,322)—F. Duffy.
Differential gears for motor vehicles (29,357)—Fraser and Glass and J. H. Young.
Passenger vehicles (29,517)—S. Gage and London General Omnibus Company, Limited.
Motor vehicles (28,930)—A. A. Holle.
Motor vehicle brake shoes (28,734)—A. H. Nicholson.
Fish-plate joints (28,863)—T. H. Sanders.
Electric traction installations for railless vehicles (28,933)—J. Vila.

Specifications Published

1921

Motor vehicles (12,613—*185,457*)—A. J. Purdy.
Electric controllers (21,495—*185,610*)—M. J. Pattison and Electro-Mechanical Brake Company, Limited.
Steering arrangements for motor road vehicles (13,501—*185,802*)—W. H. Wood and A. E. Parnacott.
Speed gears for motor vehicles (16,086—*185,836*)—J. Sadler and E. Atkinson.
Bodies of motor vehicles of the chars-a-banc and omnibus types (19,622—*185,915*)—C. Dodson.
Lifting jacks (18,581—*186,191*)—J. Coryell.
Life-guard apparatus for automobiles (19,003—*186,197*)—H. H. Hancock.
Bodies for motor vehicles (20,499—*186,215*)—E. Saxon.
Slipper brakes for vehicles (21,199—*186,224*)—W. J. Dickinson.
Contrivance for automatically braking motor and other road or rail vehicles (22,946—*186,238*)—W. Beilby.
Reversing gear for motor vehicles (33,931—*186,273*)—R. Tondeur.
Automatic trolley retrievers for electric tramcars (22,074—*186,494*)—Chilian Electric Tramway and Light Company, Ltd. (*A. Bowen*).
Journal box (18,593—*166,141*)—L. Lotte.
Convertible passenger or goods vehicles and hoods for use thereon (25,175—*186,820*)—J. Herring and D. Rowell.

1922

Operating means for the brakes of motor vehicle steering wheels (3,720—*175,276*)—L. Hersot.
Power-driven vehicles (16,937—*181,741* and 17,712—*182,471*)—Atlantic Akt.-Ges. für Automobilbau.
Control of electrically propelled vehicles (8,247—*186,013*)—British Thomson-Houston Company, Limited, and H. C. Hastings.
Lifting jacks (306—*186,549*)—A. Gustiana.

The English Electric Company, Limited, offer to forward their "Publication No. 388," an eight-page quarto booklet entitled "The Choice of Steam Conditions in Modern Power Stations," on receipt of application to their Publicity Section, 2 Taviton Street, W.C.1.

W. T. Henley's Telegraph Works Company, Limited, have removed their Liverpool office to 37-41 Duke Street. (Telephone No. Royal 790.) The increased accommodation there obtained will enable the company to carry larger stocks of electric wires and cables, flexible cords, jointing materials, etc. Mr. W. S. Campbell is in charge.

The Coronium Metal Company, Limited, Brentford Foundry, Brentford.—The name of P. R. Metals, Limited, has been changed to the Coronium Metal Company, Limited. The change of name is accompanied by no other change, and the business will be carried on as hitherto.

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1921. WEEKS ENDED Oct. 1	Oct. 8	Oct. 15	Oct. 22	Oct. 29	1922. WEEKS ENDED Sept. 30	Oct. 7	Oct. 14	Oct. 21	Oct. 28	AGGREGATE. Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	3,586	3,550	3,550	3,472	3,236	3,466	3,665	3,382	3,359	3,145	21⅓	80,062	+ 238
Aberdeen Motor Buses	261	144	171	150	130	221	267	169	176	146	21⅓	6,416	− 548
Ayr Corporation	749	578	554	504	526	711	593	558	544	511	24	20,516	− 852
Barrow Corporation	834	801	822	775	772	555	566	522	498	488	30	18,555	− 8,428
Belfast City Tramways	12,260	12,822	12,897	12,660	12,351	12,580	13,312	12,896	12,798	12,295	30	360,218	− 20,749
Birkenhead Corporation	2,809	2,810	2,784	2,601	2,614	2,446	2,379	2,319	2,234	2,168	30⅓	73,672	− 5,985
Birkenhead Motor 'Buses	646	614	649	510	579	784	682	725	673	660	30⅓	24,167	+ 1,664
Birmingham Corporation	30,395	30,250	30,259	29,503	29,033	29,379	25,714	25,316	25,438	24,930	30	840,533	− 47,323
Birmingham Motor 'Buses	2,025	2,021	2,054	1,879	1,772	1,852	1,741	1,713	1,690	1,624	30	55,688	− 8,017
Blackburn Corporation	2,796	2,701	2,642	2,715	2,567	2,618	2,366	2,491	2,428	2,265	30⅓	75,919	+ 2,233
Bradford Corporation	14,711	14,363	15,454	13,970	14,869	14,547	14,484	14,247	14,222	13,853	30	428,734	+ 11,398
Brighton Corporation	2,619	2,577	2,409	2,179	2,120	2,467	2,389	2,232	1,965	1,865	30⅔	79,629	− 1,862
Burnley Corporation	3,473	3,506	3,598	3,420	3,373	3,508	3,345	3,366	3,270	3,062	...	—	—
Burton-on-Trent Corporation ...	645	751	640	655	626	608	613	536	554	537	29	17,209	− 2,161
Bury Corporation	2,688	2,557	2,622	2,389	2,452	2,543	2,536	2,552	2,384	2,324	30⅔	76,455	+ 30
Chatham and District	1,875	2,023	1,871	1,769	1,619	1,635	1,719	1,675	1,623	1,481	43	71,731	− 1,082
Chesterfield Corporation	1,410	1,367	1,411	1,409	1,394	1,268	1,306	1,261	1,256	1,228	29	36,889	− 4,265
Derby Corporation	2,212	2,364	2,244	2,196	2,117	2,225	2,200	2,165	2,150	2,060	30	65,958	− 349
Dundee City	3,286	3,147	3,336	3,152	3,044	3,051	3,150	3,009	2,947	2,849	23⅔	71,423	− 6,315
East Ham Corporation	2,156	2,162	2,186	2,086	2,032	2,087	2,083	1,989	2,099	1,986	30½	64,025	− 82
Edinburgh Corporation	13,081	13,254	12,985	11,940	...	12,320	13,122	12,883	12,536	11,567	24	301,675	− 18,494
Edinburgh Motor 'Buses	3,576	3,525	3,450	3,173	...	2,810	2,935	2,850	2,765	3,035	24	83,599	− 7,396
Glasgow Corporation	48,114	47,738	47,771	45,696	46,288	43,092	45,729	44,933	45,051	43,117	21½	912,262	− 68,461
Glossop (Urban Elec. Supply Co.)...	264	260	260	248	247	226	241	221	239	202	43	9,722	− 420
Halifax Corporation	4,784	4,589	4,698	4,749	4,393	4,396	4,539	4,406	4,402	4,133	29½	131,823	− 1,319
Halifax Motor 'Buses	57	62	60	73	62	102	117	99	89	83	29½	2,580	+ 49
Halifax Railless Cars	66	55	58	50	54	31	23	34	33	28	29½	1,292	+ 417
Huddersfield Corporation	5,412	5,125	5,305	5,058	5,000	5,771	5,644	5,458	5,418	5,287	31	169,457	− 1,053
Ilford U.D. Council	1,571	1,521	1,489	1,439	1,423	1,402	1,447	1,419	1,445	1,390	30⅔	44,186	− 2,191
Ipswich Corporation	938	970	918	865	820	846	851	780	754	714	30	26,184	− 1,175
Isle of Thanet...	1,595	869	1,033	909	708	1,349	564	800	748	595	3½	2,707	− 812
Kilmarnock Corporation	379	370	356	362	356	331	335	322	345	307	23½	7,834	− 1,074
Leicester Corporation	7,230	7,463	7,596	7,399	7,062	7,595	7,535	7,557	7,403	7,188	43	316,267	+ 36,565
Liverpool Corporation	30,601	31,044	31,358	29,625	29,330	29,952	30,638	29,519	29,189	26,894	43	1,264,997	+ 16,201
London County Council	102,821	102,529	103,714	102,129	99,120	93,439	95,971	95,299	95,334	93,768	29½	2,789,873	− 245,436
Maidstone Corporation	553	659	505	501	438	495	719	462	474	410	29⅔	15,126	− 90
Manchester Corporation	39,682	39,218	39,792	38,697	38,338	36,025	36,785	36,234	36,126	34,896	30	1,074,676	− 114,559
Newcastle-on-Tyne Corporation ...	11,752	11,674	11,841	12,101	11,492	10,203	10,280	9,864	10,721	9,719	30	309,463	− 35,543
Nottingham Corporation	7,520	8,560	8,681	7,800	7,521	7,917	8,761	8,828	7,799	7,698	30	234,665	+ 37,044
Oldham Corporation	4,962	5,152	5,100	4,728	4,900	4,640	4,702	4,837	4,733	4,326	31	144,858	− 8,328
Portsmouth Corporation	5,576	5,466	5,340	5,026	4,846	4,761	4,718	4,435	4,137	3,844	30	161,479	− 13,691
Preston Corporation	1,969	1,935	2,013	1,918	1,854	1,811	1,870	1,776	1,795	1,703	29⅔	58,151	+ 173
Preston Motor 'Buses	...	...	...	...	...	131	143	141	139	134	29½	4,130	—
Reading Corporation	1,639	1,725	1,710	1,546	1,521	1,536	1,530	1,530	1,466	1,399	30	46,629	− 1,723
Reading Motor 'Buses	346	350	347	324	294	371	377	347	346	327	30	11,074	+ 262
Rotherham Corporation	2,430	2,456	2,492	2,418	2,326	2,054	2,143	2,130	2,086	2,097	29	61,596	− 4,056
St. Helens Corporation	1,697	1,621	1,676	1,580	1,437	1,619	1,647	1,662	1,582	1,487	30	47,723	− 6,356
Salford Corporation	10,862	11,006	11,013	10,513	10,735	9,893	10,131	10,124	9,822	9,541	30⅔	306,408	− 22,399
Sheffield Corporation...	20,058	20,239	20,227	19,499	19 708	18,609	18,638	18,314	17,696	19,498	30⅔	550,896	− 48,118
Southampton Corporation	3,257	3,274	3,217	3,128	2,931	3,160	3,133	2,999	3,012	2,808	30	95,856	+ 5,963
Southampton Motor 'Buses	95	99	104	103	99	181	188	190	193	181	30	3,615	− 1,817
Southend Corporation	2,768	2,599	2,491	2,313	2,043	2,549	2,525	2,213	2,195	2,036	30	87,171	+ 2,903
South Shields Corporation	1,874	1,854	1,777	1,729	1,821	1,612	1,638	1,552	1,584	1,543	30	51,204	− 458
Sunderland Corporation	2,645	2,811	2,677	2,672	2,636	2,515	2,384	2,361	2,202	2,324	30	77,418	− 4,043
Swindon Corporation	419	427	449	398	369	382	366	335	335	313	29½	10,848	− 1,542
Tyneside Tramways and Tramroads	1,140	1,080	1,136	1,505	942	817	845	800	1,112	780	17	15,008	− 4,872
Wallasey Corporation	2,826	2,809	2,893	2,742	2,739	2,543	2,609	2,484	2,413	2,329	30½	81,109	− 6,321
Wallasey Motor 'Buses	191	252	198	232	181	209	261	201	249	184	30½	7,692	− 46
Walsall Corporation	1,640	1,670	1,667	1,625	1,583	1,475	1,468	1,453	1,437	1,418	30	45,647	− 4,940
Walsall Motor 'Buses	953	929	940	902	890	772	792	769	759	717	30	24,362	− 4,638
Walthamstow U.D. Council	2,039	2,081	2,016	1,856	1,871	1,814	1,806	1,775	1,793	1,678	30½	58,099	− 8,080
Warrington Corporation	1,012	1,034	993	963	962	971	1,006	984	1,004	960	30	28,900	− 577
West Ham Corporation	6,092	6,036	6,202	5,934	5,810	5,605	5,822	5,662	5,569	5,512	29⅔	170,829	− 7,615
Wolverhampton Corporation ...	2,525	2,437	2,602	2,386	2,248	2,159	2,097	2,168	2,044	1,980	30	63,278	− 7,654
Wolverhampton Motor 'Buses ..	662	664	660	637	637	645	650	625	618	611	30	19,355	− 358

Underground Electric Railways Company of London, Limited.

NAME OF COMPANY.	1921. WEEKS ENDED Oct. 1	Oct. 8	Oct. 15	Oct. 22	Oct. 29	1922. WEEKS ENDED Sept. 30	Oct. 7	Oct. 14	Oct. 21	Oct. 28	AGGREGATE. Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Underground Rlys. & L.G.O. Co. ...	244,901	249,657	246,296	238,263	227,977	236,094	240,738	238,793	233,628	227,579	43	9,800,053	− 434,062
London and Suburban Traction ...	56,834	58,791	57,442	54,099	50,852	45,067	45,948	45,244	43,828	41,876	43	2,072,549	− 313,767

Colonial and Foreign Tramway Traffic Returns.

Companies Issuing Weekly Returns.

NAME OF COMPANY.	1921. WEEKS ENDED Oct. 1	Oct. 8	Oct. 15	Oct. 22	Oct. 29	1922. WEEKS ENDED Sept. 30	Oct. 7	Oct. 14	Oct. 21	Oct. 28	AGGREGATE. Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	81,899	79,079	85,527	82,195	84,063	89,334	88,273	90,247	91,425	89,665	43	3,626,666	+ 195,177
Calcutta ... ... Rs.	100,530	105,872	95,859	86,930	37,399	97,475	94,575	108,761	106,006	114,967	43	4,585,950	+1,222,270
Madras... ... ... Rs.	45,129	(2 weeks)	45,814	(2 weeks)	45,810	44,181	(2 weeks)	47,337	(2 weeks)	44,054	43	974,096	+ 148,082
Pernambuco ... ... $	4,008	4,117	3,927	3,839	3,897	3,977	4,030	4,030	3,870	3,887	43½	157,332	− 10,494

Companies issuing Monthly Statements only.

	1921. May	June	July	Aug.	Sept.	Oct.	1922. May	June	July	Aug.	Sept.	Oct.	Wks.	AGGREGATE. 1922.	+ or −
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo	4,570	4,135	3,842	3,810	4,231	...	3,329	4,212	3,770	3,990	4,414	...	24	25,188	− 521
Brazilian Trac. Mlrs	14462000	14257000	15477000	15744000	14471000	...	16093000	16266000	16655000	17168000	17572000	...	39	143,910,000	−18,019,000
Brisbane	...	...	48,850	50,675	46,220	...	...	...	49,470	55,260	49,150	...	39	446,110	+ 22,070
British Columbia $	826,039	803,903	840,155	844,154	845,185	...	827,701	802,511	834,772	842,274	836,603	...	13	2,513,649	− 15,845
Buenos Ayres L'c'z	58,492	51,071	51,944	55,873	55,873	...	59,278	52,642	57,227	55,873	58,492	...	13	171,592	+ 7,902
Burma ... Rs.	48,353	54,275	43,764	55,168	58,974	...	65,357	61,823	61,637	57,864	61,829	...	8	119,693	+ 5,551
Cape Town ...	27,407	25,038	25,571	25,164	25,755	...	28,006	24,638	26,046	24,970	25,760	...	—	—	—
Carthagena & H. ...	1,602	1,410	1,936	1,773	4,244	3,862	2,793	1,174	2,257	1,880	1,721	3,182	43	23,991	− 2,107
Cordoba	...	...	23,129	23,616	23,841	...	...	26,622	27,118	27,926	...	...	21	132,661	+ 16,462
East India ...	4,392	4,494	4,591	4,513	4,154	4,084	3,960	3,640	3,859	4,069	3,612	3,727	13	11,408	− 1,343
Kalgoorlie... ...	2,362	2,308	2,350	2,652	...	...	2,636	2,437	2,498	3,090	...	...	34	19,802	+ 2,512
La Plata	...	5,187	5,425	5,811	5,930	6,587	...	5,883	6,643	6,470	7,286	7,286	43	66,487	+ 14,841
Manila ... $	293,873	310,559	305,126	297,128	322,212	...	273,218	291,434	291,093	298,788	296,842	...	39	2,641,326	− 93,260
Monte Video ...	46,579	42,960	42,411	44,672	44,927	47,297	48,074	44,298	48,672	46,463	48,372	51,825	52	567,123	+ 11,400
Para	22,705	22,833	22,605	20,890	20,175	...	23,651	23,942	23,862	24,050	24,932	...	43	232,944	+ 10,229
Port Elizabeth ...	6,304	6,180	6,515	6,324	6,477	...	6,713	6,412	6,623	6,578	6,424	...	—	—	—
Rangoon ... Rs.	138,950	130,000	133,536	133,000	132,225	151,000	145,450	140,400	140,250	137,738	141,800	155,841	43	1,419,787	+ 74,516
Winnipeg ... $	433,836	432,894	390,109	393,823	417,174	...	427,880	405,688	397,684	399,498	426,362	...	39	3,928,504	− 63,272

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The A.E.C. triumphs everywhere, and, by its remarkable achievements, is known to be *the* superior commercial motor chassis.

Extract from "Glasgow Evening Citizen."

"This was an A.E.C. similar in type to the large fleet that operates in London, except that for provincial work a four-speed gear box is fitted. This 'bus, after a run through Glasgow, tackled Scott Street, off Sauchiehall Street, making two ascents and descents without any difficulty. Scott Street is the steepest street in Glasgow, the gradient at one point being less than 1 in 4.

"Obviously, a vehicle with sufficient power to tackle this, and with brakes sufficiently adequate to stop it at any point, is suitable for any ordinary class of work."

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"A demonstration of the qualities of the new '4' type A.E.C. 'bus was given by the Peric Motor Co., Ltd., of Edinburgh, who are the Scottish Distributors, to the representatives of the Glasgow Tramways. After a short run through the city two ascents of Scott Street were made, this being the well-known hill off Sauchiehall Street, with a gradient of 1 in 3·859. The ascents and descents were made without any difficulty, and greatly impressed those present. This 'bus is, of course, of similar type to that operating in London, except that for provincial purposes a four-speed gear box is fitted."

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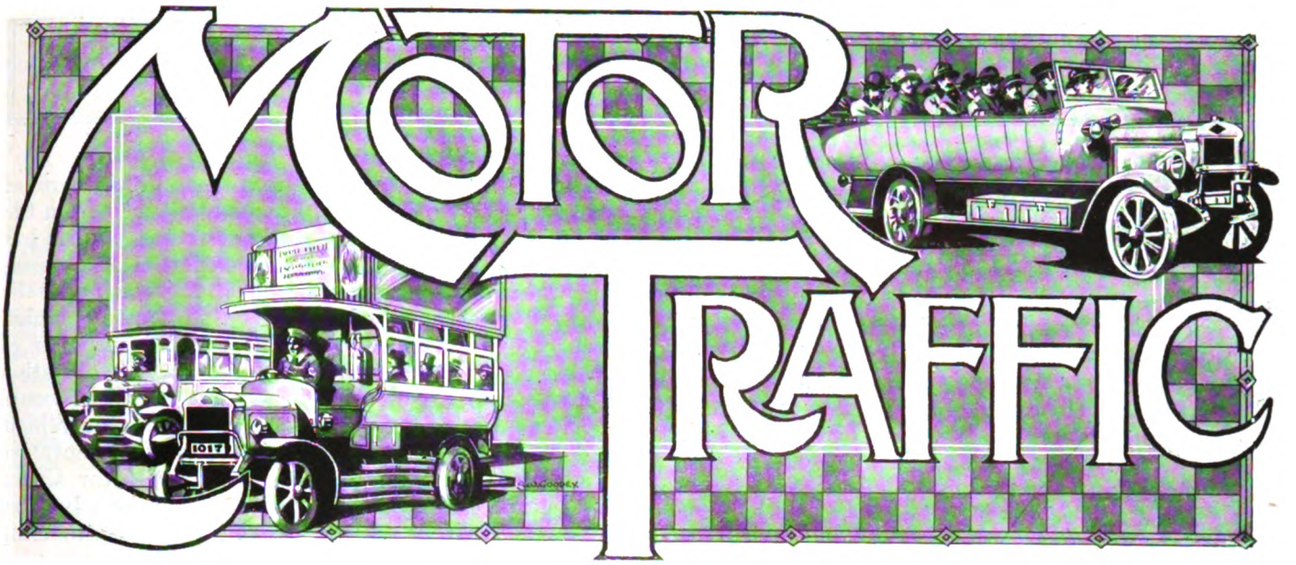

MOTOR TRAFFIC SECTION—SEVENTEENTH YEAR OF PUBLICATION.

NEW METHODS OF TAXATION.

The Ministry of Transport has made it quite clear that any scheme of taxation whereby the requisite revenue can be raised without increasing the cost of collection would be considered as an alternative to the present system. Naturally the possibilities of a revision of a tax which in the opinion of many bears with unfair hardship on certain sections of motor vehicle users is causing some deep thinking. The system of taxation according to the horse-power of the car finds few friends amongst the large number of motorists whose interest is chiefly bound up in the pleasure side of motoring, and as the power of this section is well organised it may be taken for granted that well-directed effort will be used to effect some change in the system. In the industrial field opinion appears to be divided, although, judging by the result of a lengthy discussion which took place at a recent meeting of the National Council of the Commercial Motor Users' Association in Nottingham, the members of that body are opposed to any change in the present system. On the other hand, however, there appears to be complete agreement between all the other associations—with the exception of the London and Provincial Omnibus Association—representing a large number of users and manufacturers and traders in every branch of the motor vehicle industry, that the bulk of the revenue required should be raised by means of a flat rate motor spirit duty. As a result of collaboration between the members of these associations a memorandum is being presented to the Government proposing to abolish the present system of taxation, as far as petrol vehicles are concerned, and substituting a scheme whereby practically three-fourths of the required revenue be raised by a fuel duty and the balance by means of a registration duty and the tax on steam, electric, and producer-gas consuming vehicles on the present scale. There can be no question that in the case of the user of motor vehicles, either in passenger service or for the transportation of goods where the nature of the service is intermittent, the present system of taxation is most unsatisfactory, and is an unfair handicap on enterprise. On the other hand, where full loads are regularly obtainable and the maximum capacity of the vehicles is constantly employed, the preference for the present system is quite understandable, although the net result may not be altogether equitable in relation to the wear and tear of the roads.

MOTOR OMNIBUSES AS MISSIONARIES.

Probably nothing has been more effective in leading the trading community of Great Britain up to a serious consideration of the advantages of motor transport than the extensive use of motor omnibuses in London and elsewhere. When the trader realises that the omnibuses used in our capital city cover in the aggregate upwards of a hundred million miles per annum, and carry over a thousand million passengers in the year, he can hardly fail to ask himself whether there is not some room for the use of motors in connection with his own business. In this sort of way the motor omnibus may become a very useful missionary in the interests of trade motor vehicles of all kinds. This is, perhaps, particularly the case in countries where for one reason or another the majority of the trade vehicles hitherto employed have been of indifferent quality and none too reliable. In any such instance a really well organised omnibus fleet composed of good vehicles is a daily public demonstration of the possibility of better things than have hitherto been locally realised. Whenever a service of high-class British omnibuses is established in a foreign city, the result must sooner or later be beneficial to the whole of the British industry, and not merely to the maker of the omnibuses alone.

As an example of the argument, let us take the case of Spain. That country has been more or less flooded during the last few years with the surplus military vehicles of the various combatants in the great war. The result in the aggregate cannot have been such as to inspire great confidence in the dependability of commercial motors. Moreover, many of these vehicles are of a somewhat clumsy and heavy type, and their effect upon rather inadequate roads may well have proved to be very detrimental. Now, fortunately, both the political and the commercial capitals of Spain are inaugurating motor omnibus services, and have

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MOTOR TRAFFIC

selected well tried British vehicles for their purpose. If these services are as well run as they are equipped, the public demonstration must lead to a demand throughout Spain for British vehicles, based upon the feeling that it was only when British vehicles were employed that real reliability was secured. Were the thing practical, which it probably is not, it might even prove to be worth the while of the British industry as a whole to subsidise an individual manufacturer in order that he should secure an overseas order for motor omnibuses in competition with the foreigner. Everything also should be done to ensure that, when the omnibuses are put into service, the organisation and all details of maintenance should be in the hands of thoroughly competent engineers who, if not actually British, have at least British experience.

CENTRAL MANAGEMENT OF MOTOR VEHICLES.

From time to time attention has been drawn in these columns to the importance of central management of public service motor vehicles, and we note with satisfaction that Mr. Vincent Turner, the borough engineer of Rotherham, has in his annual report recommended the adoption of a scheme of centralisation. In his opinion the scheme he propounds should not only result in more efficient service for each of the departments requiring motor transport, but should also much reduce the cost of such services. In common with all municipalities where the head of each department has been responsible for the purchase and maintenance of the vehicles required in that particular department, a wide variety of makes and types have been supplied to Rotherham. As this means an attendant stock of spares for each type, it is obvious that a reasonable reduction of types alone must make for economy. A far more important advantage to be gained from central management, however, is due to the fact that all the vehicles owned by the Corporation can be made available for service when and where required. It is common knowledge that with the departmental system it must of necessity happen that whereas additional machines could with advantage be used in one department if they were available, vehicles in excess of the requirements for the time being are standing idle in another department. Under the system advocated by Mr. Turner, which we believe is already in operation in a few municipal undertakings, all the vehicles would be concentrated in one department under the management of a traction engineer, who would be responsible for their equipment and maintenance for the various services to be covered. Each department requiring the use of machines would send in a daily requisition for the number and type of vehicle required, the machines being apportioned in the order of priority if the demand was greater than the supply on any one day. A certain amount of give and take between the departments would, of course, be requisite to ensure the smooth working of the system. Many other advantages would undoubtedly follow central management, not the least important being uniform charges based upon the running of the whole fleet, while the development of the use of interchangeable bodies made possible by this system would make for all round economy and efficiency.

MOTOR COACH ORGANISATION.

The disastrous results which the proprietors of passenger-carrying vehicles have experienced from the operation of their services during the past season has created a keen desire for the formation of an association which shall have for its object the placing of the industry on a sounder basis. At the moment opinion appears to be divided as to whether the interests of the industry will be served the better by the formation of a new national association whose sole object would be the welfare of the passenger carrying motor vehicle trade, or by the organisation of a representative coach trade section of the Commercial Motor Users' Association. Many sound arguments can be advanced in favour of either scheme, providing the membership is thoroughly representative. In view, however, of the danger of overlapping it would certainly appear that with the knowledge and experience which has been gained by many years' operation of industrial vehicles the Council of the C.M.U.A. should be in a position to give valuable information on many points which must of necessity affect either section of the motor industry. For this reason it is satisfactory to know that the C.M.U.A. has decided to hold a special meeting of its passenger vehicle committee for the purpose of thoroughly discussing the whole subject of coach trade organisation. That the matter is urgent is abundantly proved by reports coming from all parts of the country showing the unsatisfactory state of the industry. Excessive competition, the haphazard manner in which unsuitable vehicles have been put into service, coupled with the more or less bad weather which was experienced throughout the season, have combined to produce a condition most urgently needing a remedy.

SIX-WHEELERS.

It looks as if the time will presently come when practically every commercial vehicle manufacturer will produce an adaptation of one of his heavier models so as to enable him to offer a six-wheeled vehicle of the flexible type. This policy does not necessarily mean any appreciable sub-division of output, since in most essentials the power portion of the six-wheeler may be identical with a four-wheeled lorry already manufactured. The efficiency of the flexible six-wheeler rests largely on the elementary fact that it is easier to pull than to push a load. Its prospective popularity depends also on the fact that axle weights have necessarily to be limited in the interests of those responsible for road maintenance. It is upon axle weight rather than upon total weight that the crushing and consequent wear of the road depends, and it is obvious that, if the load is carried on three axles instead of two, the weight can be so distributed as to provide for a larger total load without the prescribed axle weight being exceeded. As compared with the ordinary tractor and trailer combination, the special advantage of the six-wheeler is that a considerable portion of the load helps to secure adhesion of the driving wheels. In the independent tractor, otherwise unnecessary weight is often involved because it is required for adhesion. Consequently the percentage of useful load to total weight may be made materially higher in the case of the flexible six-wheeler.

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A NEW LONDON OMNIBUS SERVICE.

MR. FROST SMITH'S ENTERPRISE.

In order to demonstrate the advantages of his improved petrol-electric system for public service vehicles, Mr. Percy Frost Smith, of 64, Victoria Street, Westminster, proposes to establish a service of omnibuses on London streets. The advent of a new motor omnibus service outside the control of the L.G.O.C. is in itself a matter of exceptional interest, as it is an event marking progress in the passenger transportation field with the added spice of competition for public favour. When the enterprise is associated as in the present instance, with the introduction of a new type of chassis, it is sure to receive the closest scrutiny from all those responsible for the running and maintenance of omnibus services.

Frost Smith 48-Seat Omnibus.

As is well known, the outstanding feature of the petrol-electric system of power transmission is the elimination of the clutch and gear box, and the substitution of the electric drive, which finds so much favour in all types of passenger vehicles because of the absence of the sudden jolt or jerk which usually accompanies the starting of the clutch-operated vehicle.

In Mr. Frost Smith's new model omnibus, which is illustrated below, and which will be known as the "F.S. petrol electric," all the advantages of the older types are embodied, while a number of entirely new features are incorporated, which not only make for refinements in design, but ensure safe working. The most important of the new features from the safety point of view is unquestionably the provision of an electric brake, the operation of which forms one of the regular movements of the controller lever, so that under the worst possible road conditions no physical strain is placed upon the driver. It is claimed for this new system of control, which was fully described in our issue of October 12, that it ensures safety, economy, and perfect control. In view of the fact that a fully loaded vehicle can be taken down a steep gradient without the use of any mechanical brake, these claims appear to be well justified. It will be seen that the body, built by Christopher Dodson, Ltd., has been designed upon attractive lines and presents a pleasing appearance. In height, width and length advantage has been taken of the maxima permitted by the Metropolitan Police Authorities for this type of omnibus, so that a very comfortable vehicle has been produced. The seating plan gives accommodation for 48 passengers, 22 inside and 26 outside. In the interior there are eight seats, each taking two passengers, facing the driver, and two longitudinal seats each taking three passengers. These are all furnished with deep spring cushions, well upholstered in red. Ample space has been provided on the rear platform, and as the entrance is wide, rapid loading and unloading is thus facilitated. On the top deck all the seats are of the usual garden type facing the driver. Loose knee aprons are provided, these being folded and hung on rails specially provided for that purpose when not in use. An excellent lighting system has been installed, which will ensure a brilliantly illuminated interior as well as the usual outside lamps. The colour scheme is in blue and cream, with upper parts in cream lined in blue, the panels, radiator, etc., being painted a bright royal blue. The name panel has a cream ground with letters in gold with blue shading. The vehicles ride with remarkable ease, even when running on stone paved roads. This easy riding is due to the well considered combination of the excellent springing of the chassis, the well upholstered seats and the resiliency of the Harboro' Rubber Company's tyres with which they are fitted.

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A.E.C. OMNIBUSES.

ELECTRIC VEHICLES ORDERED BY PROVINCIAL UNDERTAKINGS.

The photograph reproduced below gives evidence of the increasing use of the double-deck omnibus in provincial services. It has to be borne in mind that a double-deck vehicle proves profitable only in crowded areas. Readers will therefore see that when the purchaser stipulates for the latest type of machine, affording accommodation for as many as 54 passengers, there must be heavy traffic to be carried. This, of course, is true in the case of the Birmingham Corporation tramways and omnibus department, the British Electrical Federation, Limited, who run omnibuses in many provincial districts, and the East Surrey Traction Company, who serve numerous large towns and rural districts outside the 12-mile radius of London. Each of these undertakings has ordered vehicles of the A.E.C. model 4, or "S" type, seating 54 passengers. Birmingham Corporation has ordered one, the British Electrical Federation four, and the East Surrey Traction Company six.

A.E.C. Omnibuses in Provincial Services.

(A) Birmingham Corporation; (B) British Electrical Federation; (C) East Surrey Traction Company.

PETROL PUMP LEGISLATION.

The London County Council have received from the Public Control Committee a report on the subject of petrol measuring pumps at public filling stations, and the results of tests of their accuracy made by the Council's inspectors.

Sixty-eight pumps were examined, and of these only 23 were found to be correct or within the limits of error permitted under the Board of Trade regulations. Of the remaining 45 it was found that 12 were in excess by various quantities, 2 were correct in some deliveries but in excess in others, 14 were deficient by various quantities, 10 were deficient in some deliveries and in excess in others, while 7 were correct in some deliveries and deficient in others. In deliveries represented as one gallon, the largest amount of error in excess was 1½ pints, the greatest deficiency being 1 pint. With one exception, the 68 pumps were of two patterns, both approved by the Board of Trade.

In view of the discrepancies disclosed by the examination, communications were sent to the makers informing them of the results of the tests. In reply, one of the firms states that it has no control over measuring pumps after installation, but that if any user of a pump intimated that it was inaccurate, a mechanic would be sent to put it in order. The firm also points out that at present it is possible for pumps to be tampered with, but that an inspector's seal could be affixed in such a way as to prevent this. The second firm states that when a pump is installed it is handed over to the pump owner after being tested, and passes out of the firm's control. The firm adds, however, that it has been the practice periodically to visit and inspect such pumps in order to ensure that they have been properly lubricated and kept clean.

Referring to the report as revealing a most unsatisfactory state of affairs, the committee suggest that the County Council should support strongly proposed legislation to empower the Board of Trade to bring all petrol and oil-measuring pumps under regulation and periodical inspection.

THE "SHOCK-SHIFTER" HUB.

Renewed attention is now being given to the Muir shock-shifter hub for automobile vehicles, which is manufactured by Messrs John Muir and Son, 3 Arundel Street, London, W.C. Experiments of an encouraging kind were made with the device before the great war, but when that disaster broke out further progress was stayed. But now, when freedom and competition have been restored, there are prospects of really useful inventions coming into their own.

Any device which can reduce the shocks to a motor vehicle arising from inequalities of the road surface is bound to be of great value, provided that it is reliable and not too expensive either in first cost or maintenance. The saving, of course, is two-fold—a reduction in road maintenance and a saving in repairs to the vehicle. Springs are very good as far as they go, but if, in addition to springs there can be an arrangement round the wheel axle which will largely prevent jars from reaching the springs, much will be gained.

The idea of the Muir device is to interpose between the hub and the body of the wheel an annular chamber containing a number of steel balls which do not quite fill the chamber. The wheel is free to move, in the vertical plane, a certain distance which is limited by a number of equally spaced bolts registering in the flanges of the hub, but having considerable clearance in the wheel itself. The idea is that these bolts constitute what practically amounts to a liquid medium, of which the motion is affected by the movement of the wheel due to road shocks, whereby the moving columns of balls shall play the part of an energy absorber. When the vehicle is stationary on the road, the hub tends to rest upon the balls at the bottom of the chamber, displacing some of these so that the wheel and axle are eccentric with one another. When the vehicle is in motion centrifugal action asserts itself, whereby the balls tend to dispose themselves symmetrically around the annular space, their symmetry being of necessity upset, to some extent, when the wheel is given an upward movement due to road shock. It is this change of motion of the balls (to effect which the application of force is, of course, necessary) that absorbs some, at any rate, of the shock. In actual practice the idea seems to work out very well.

The system has the initial advantage that its adoption does not involve a high capital cost. Further, it may enable the owners of lighter vehicles to substitute solid for pneumatic tyres, and thus avoid much cost and inconvenience. If, again, it is found that wear of road surfaces is materially reduced, both manufacturers and users of motor vehicles will find it in their interest to adopt a device of the sort here described.

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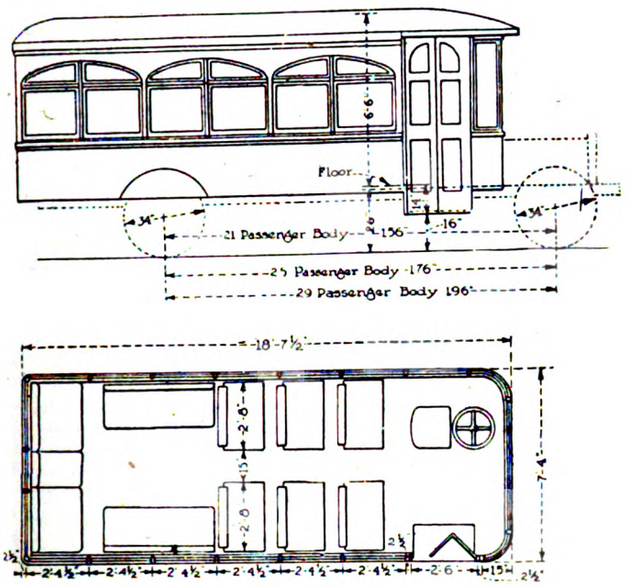
PROPOSED AMERICAN STANDARD OMNIBUS.

A development that appears to mark a definite effort on the part of American street railways to meet jitney and other omnibus competition is the adoption by the American Electric Railway Association of provisional plans and specifications for standard



Proposed American Standard Omnibus.

motor omnibus construction. Some of the dimensions of the proposed standard vehicle are as follows—

Number of passengers ...	21	25	29
Wheelbase	13 ft.	14 ft. 8 in.	16 ft. 4 in.
Engine (horse-power) ...	30	40	50
Tread, front and rear ...	5 ft. 6 in.	5 ft. 6 in.	5 ft. 6 in.
Capacity of rear (tons)...	2	2½	3
Braking surface (sq. in.)	150	175	200
Approx. maximum weight (lbs.)	4,500	5,000	5,500

Among other recommendations are a low hung type of chassis frame, with a maximum frame height of 26 in., spring suspension, engines, preferably of the poppet or sleeve valve type, with a maximum speed not exceeding 1,300 revolutions per minute, gear ratio not to be less than 7 to 1 or more than 12 to 1, metal plate or spoke wheels, and 34 in. solid or semi-solid tyres, with pneumatics in cases where low floor heights are not required.

L.G.O. COACH TOURS.

The London General Omnibus Company ran some 300 motor coach tours during the past season. Approximately 26,000 miles were covered without accident of any kind. Not for eight years has there been any mishap to any omnibus privately hired, and the same can be said of the coach tours which the company first began to run in 1920.

There were 38 coaches, and the drivers were specially selected from the many hundreds which the company employ as being exceptionally careful and skilled men. They are particularly fitted for the driving of the coaches, being used to the manœuvring of a London omnibus in heavy traffic, a task which has been described as "the hardest job in London."

The coaches have been designed and built with the same meticulous care. They were constructed by the Associated Equipment Company at the well-known works at Walthamstow. The same works have produced London's fleet of 3,000 omnibuses. The coaches are of three different types, seating 28, 23 and 19 passengers respectively, and each type has been designed to allow a wide margin of safety having regard to the number of passengers carried.

SINGLE-DECK LEYLAND OMNIBUS.

The omnibus illustrated below has recently been supplied to the Crosville Motor Company, of Chester, by Leyland Motors, Limited. The vehicle is one of the latest productions of the Leyland workshops, and its outstanding feature is the large seating accommodation provided on one deck without excessive over-all length. The chassis is of the standard "G" type, 4-tonner, with the exception that the wheel-base is slightly longer, and that the steering and driver's controls are arranged at the side of the engine, in order to allow further space for passengers. The three entrances with which the omnibus is provided are all on the near side, and between the two rear entrances a gangway runs down the middle of the vehicle, so that passengers can enter by the front and leave by the rear door. The chassis is so designed that the engine, clutch and gear box can be taken out without removing the body. The Crosville Motor Company have now over 20 Leyland omnibuses, mostly of the single-deck type, and these vehicles have proved very successful in this extensive Chester service.

Single-Deck Leyland Omnibus with Separate Doors of Entrance and Exit.

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REGULATION OF OMNIBUSES.

PROPOSALS OF THE ASSOCIATION OF MUNICIPAL CORPORATIONS.

The Association of Municipal Corporations has adopted a report prepared by a sub-committee of the Law Committee, dealing with the question of the licensing and regulation of hackney carriages, and the report has been forwarded to the Departmental Committee which is considering the subject. The report is as follows—

(1) The existing power of making bye-laws for regulating omnibuses is contained in Sec. 6 of the Town Police Clauses Act 1889, which admittedly affords insufficient scope for dealing with the motor omnibus traffic, and no doubt the Departmental Committee on Road Vehicles will recommend the revisions necessary in Section 6 to make it harmonise with modern requirements. There are several matters in connection with motor omnibus traffic which cannot be controlled by bye-laws made under the existing law, and in regard to which the law should, it is submitted, be amended.

(2) Stopping points for picking up or setting down passengers. At the present time omnibuses stop at any point that suits them, but in main thoroughfares of the town it is a great inconvenience, and source of danger to have vehicles constantly pulling into the kerb and stopping to pick up or set down passengers, and often holding up other traffic where the roads are narrow. In the present state of the law it is doubtful whether a driver has any option but to stop and pick up a passenger waiting to be carried if the omnibus is not full, and the powers contained in Section 6 regulating "the conduct" of a driver would hardly be sufficient authority to support a bye-law on these lines. Local authorities can to-day regulate the places where tramcars shall stop (and presumably where they shall not stop) under Section 46 of the Tramways Act 1870, and power to deal with omnibuses in the same way should be made available. The power should enable the local authority by resolution or order to determine the points at which omnibuses shall stop to pick up or set down passengers, and also to prohibit the taking up or setting down of passengers except at the points indicated.

(3) *Power to specify the route to be taken by an omnibus.*—The local authority may grant such number of omnibus licences as they may think fit (s. 37 T.P.C. Act 1847; s. 4 T.P.C. Act 1889), but the refusal to grant a licence or the insertion of a condition in a licence is now subject to an appeal to the Minister of Transport, whose decision is final (s. 14 (3) Roads Act 1920).

(4) The usual form of omnibus licence allows an omnibus to ply for hire anywhere within the area of the local authority granting the licence, and while the T.P.C. Acts do not in terms appear to allow the local authority to impose any limitations in the licence, the Roads Act of 1920 recognises a right to impose conditions.

(5) The case must frequently arise where a local authority considers that a sufficient number of omnibuses holding general licences have been granted, while at the same time it would be to the public advantage to issue further licences to the proprietors of omnibuses who were willing to confine their vehicles to a particular route within the district (and probably beyond) where the inhabitants were in need of such a facility, and it would be unfortunate if licences limited in this way could not be granted.

(6) Another instance in which this power is needed arises where existing routes are well provided with travelling facilities and application is made for omnibus licences where it is intended the vehicles shall take alternative routes to those in use but using the same terminus at each end. A general licence in such a case is not desirable, but a licence restricting the omnibus to a particular route would be of public advantage.

(7) There is also the broader question whether the time has not arrived when all omnibuses should be confined to the route or routes to be specified in their licences. Local authorities have practically complete control over the construction and use of new tramway routes, and now that omnibus services have become so extensive and numerous, some similar control over omnibuses is necessary in the hands of the authority. Omnibuses are to-day making extensive use of third-class roads (towards which no contribution is made by the Ministry of Transport), and are causing considerable damage both to the roadway and the adjoining properties; these roads were never intended to carry this class of traffic. It will no doubt be pointed out that in such cases the authority can apply for an order under s. 7 (4) of the Roads Act 1920, but it is hardly feasible to schedule every third-class road in the district, and in view of the recommendations contained in par. 221 of the second interim report of the Departmental Committee, there is little chance of any such application being granted; the recommendation is in the following terms—

> The committee strongly recommend that applications for restrictive powers of a local character in respect of road traffic should be resisted, and should be refused save in very exceptional circumstances, and that, when a case has been made out for local restrictions, any powers conferred should not be of a general character, but should be strictly confined to those necessary for dealing with the actual special difficulties existing at particular places in that locality.

(8) *Power to prescribe the extent to which omnibuses should be allowed to use the route.*—This power would be useful for the purpose, amongst others, of prohibiting the taking up or setting down of passengers between prescribed points unless such passengers travel beyond such points. The proposal extends the powers sought in paragraph (7) above, and while allowing omnibuses to use routes where transit facilities exist which fully meet the needs of the public, would prevent the long-distance traveller wishing to proceed beyond; e.g., the tramway terminus, from being crowded out by persons using the omnibus for a short stage only, and would thereby enable the omnibus to cater for a class of traffic different to the tramway traffic.

(9) *Power to require a certificate as to the mechanical efficiency of the chassis and the workmanship of the body, or in the alternative to charge a fee for the necessary expert inspection by the licensing authority.*—It will be seen from pages 19 and 20, paragraphs 59 to 66, of the second interim report of the Departmental Committee that this matter has already received some consideration, and that the committee recommend that the police should be empowered to examine the braking requirements on all vehicles, but they add that—

> The inspection of public passenger carrying vehicles is upon a different footing, and the committee will deal with this matter in a subsequent report.

The power referred to in the above heading is an essential one, and it is suggested that it should be framed as indicated in the first part of the heading.

(10) *Omnibus Stands.*—The Act of 1889, s. 6, enables the authority to make bye-laws fixing omnibus stands and places where omnibuses may stop a longer time than is necessary to pick up or set down passengers. For many years past the Local Government Board (now the Ministry of Health) allowed bye-laws providing that the stands, etc., should be such as might be specified in an executive order to be made by the local authority from time to time, and the case of Blackpool Local Board of Health *v.* Bennett (1859, 4 H. and N. 127), which related to the fixing of hackney carriage stands, would seem to show that such a bye-law is valid. The Minister of Health, however, now takes the view that a bye-law relating to stands for omnibuses must in terms describe the stands, etc., so as to afford all parties an opportunity of making objections before the bye-law is allowed, a course which would not be available if stands, etc., were fixed by an order of the local authority.

(11) The result of the Minister's ruling is that upon every occasion the authority wish to make, alter or annul a stand for omnibuses, new bye-laws are necessary, with all the attendant formalities and delays. It is no exaggeration to say that bye-laws cannot as a rule be made and allowed under a period of from three to four months.

(12) It is submitted that the local authority are the proper body to fix the places for stands, etc., within their area, and their decision (which as a rule is only given after affording the proprietors of omnibuses an opportunity of considering their proposals) ought not to be subject to appeal to any other body.

(13) The Minister of Health already takes the view that he can allow bye-laws fixing stands to be exclusively used by different classes of omnibuses according to their use or destination, but it is desirable to place the matter beyond question, and it is therefore suggested that the local authority should be empowered by resolution or order to fix from time to time the stands for omnibuses and the places where omnibuses may stop a longer time than is necessary to pick up or set down passengers, and also to fix separate stands for different classes of omnibuses according to the particular purpose for which they are used, or the highways used by them, or having regard to their destination, to the exclusion of other omnibuses, and to limit the time or times during which such vehicles may remain upon the stands, etc., so fixed.

(14) *Limitation of Fares.*—Whilst the maximum fares that can be charged on tramways are fixed by the Act or Order in pursuance of which the tramways are constructed, there is no limitation upon the charges to be made in respect of omnibuses. It appears to us

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that the local authority should be entitled to prescribe the maximum fares as a condition of granting the licence.

(15) *Time Table.*—We are also of opinion that a local authority should have some voice in determining the times at which the omnibuses should start from any terminus within their district.

(16) *Separate licences for (a) regular service omnibuses using defined routes, and (b) omnibuses making pleasure trips only. Conditions on Licences.*—We are of opinion that omnibus traffic should be divided into the two groups above mentioned, and separately licensed by the local authority accordingly; power should also be expressly conferred enabling the local authority to impose appropriate conditions on each class of licence, and provision made that on breach of any condition the omnibus shall be deemed to be unlicensed.

(17) *Conduct of Passengers.*—We are of opinion that the local authority should be empowered to make bye-laws regulating the conduct of passengers when using omnibuses.

OMNIBUS SERVICES.

BARRY.—At the request of the Barry Omnibus Owners' Association, supported by a petition from ratepayers, the Urban Council have withdrawn their veto on Sunday services. Six-day licences have been issued, and the question of Sunday operation has been left to the decision of the Ministry of Transport.

LEEDS.—In connection with the municipal elections, candidates received a communication from the Leeds and District Chamber of Trade, taking exception to the Corporation's proposal to spend £150,000 in extending the tramway service to Middleton, and asking candidates to favour the provision of a motor omnibus service instead.

MANCHESTER.—The Corporation are purchasing a Karrier one-man single-deck petrol omnibus.

NEWCASTLE-ON-TYNE.—In the annual report of the Corporation Transport and Electricity Committee, Mr. E. Hatton, engineer and general manager, states that the public are increasing their patronage of the various services of omnibuses operating as feeders to the outlying tramway termini. Whereas in the previous year the number of passengers carried was 1,821,077 and the receipts £20,026 for the 241,623 miles run, the figures for 1921-22 show substantial increases, the number of passengers being 2,078,637, the receipts £32,366, and the miles covered 457,498.

SHEFFIELD.—The Parliamentary Committee of the Corporation propose to seek sanction for the running of omnibuses outside the city. The Tramways Committee have decided to appeal against the recent conviction of the Corporation in respect of the use of an omnibus on trial with trade plates. The justices held that the omnibus should have been duly licensed, inasmuch as it was plying for hire, though the Corporation were testing it on a route to ascertain its capacity and value for traffic purposes.

An A.E.C. Model 4 Omnibus Built for Edinburgh Corporation Tramways.

BIRKENHEAD.—The Tramways Committee propose to purchase another motor omnibus at an estimated cost of £1,100.

BIRMINGHAM.—New omnibus services have been instituted by the Corporation. Eight single-deck vehicles of the one-man type with a front entrance are in use, each carrying from 29 to 24 passengers. The Birmingham and Midland Omnibus Company are running a number of 20-seat omnibuses on Garford chassis, with Goodyear pneumatic tyres.

BLACKPOOL.—The Watch Committee are urging the Ministry of Transport to give their promised consideration to the licensing of motor coaches and the fixing of stands therefor.

DONCASTER.—The Corporation have decided to purchase ten omnibuses from the Bristol Tramways and Carriage Company for the purpose of establishing a municipal service.

EXETER.—The advisability of running a motor omnibus service in thickly populated parts of Exeter not served by the tramways is being considered by the Exeter Tramways Committee.

HUDDERSFIELD.—The Corporation have declined to accede to the request of Golcar Urban Council to place letter-boxes on their omnibuses, seeing that the boxes would have to be transferred to the tramway cars at the end of the omnibus route, thus dividing the responsibility for the safe custody of the letters.

HULL.—It was suggested at the City Council that steps should be taken to prevent the motor omnibuses on the Beverley Road robbing the tramway cars of passengers, one of the members asserting omnibuses were deliberately going down the road in front of the tramway cars and picking up passengers who were waiting for cars.

STIRLING.—The Scottish General Omnibus Company have been granted licences for forty omnibuses and coaches.

STOCKPORT.—The Corporation have decided to run omnibuses to Reddish.

SYDNEY, N.S.W.—The Municipal Council have decided that, with regard to damage done to the roadway by vehicles fitted with steel tyres, the Government are to be again approached with a view to the substitution of rubber tyres for the steel ones now used on many of their motor lorries, and also that the Government are to be urged to frame a traffic regulation prohibiting the use of steel tyres on any vehicle licensed to use a public roadway, excepting horse-drawn vehicles.

WORTHING.—The Southdown Motor Services, Limited, have been informed by the Corporation that proceedings will be instituted in the event of further infringement of the by-laws relating to overcrowding of omnibuses, except as regards standing inside.

RURAL OMNIBUS SERVICES.—The Rural District Councils Association have empowered their Parliamentary Committee to go into the question of motor omnibus and chars-a-banc services, more especially with regard to speeds, routes, termini, time tables, stopping places, supervision of vehicles, and limitation of number of passengers, with the object of securing for rural authorities some powers of control in these matters.

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MOTOR VEHICLES FOR MUNICIPALITIES.

MIDDLESEX COUNTY COUNCIL have purchased a civic car for £800.

BLACKPOOL TRAMWAYS COMMITTEE have authorised the purchase of a Fordson tractor.

WALLASEY CORPORATION have decided to purchase a light motor wagon up to a capacity of 30 cwt.

ILFORD HEALTH COMMITTEE have suggested the purchase of a Ford tonner for house refuse collection.

BOURNEMOUTH CORPORATION PARKS COMMITTEE have decided to purchase an additional 2-ton motor lorry.

BIRKENHEAD CORPORATION are considering the introduction of motor transport in their various departments.

HALIFAX WATCH COMMITTEE recommend the purchase of a 20 H.P. chassis to be used with a horse ambulance body.

POPLAR BOROUGH COUNCIL propose to purchase a Laffly motor-driven street sweeping machine at a cost of £975.

MANCHESTER CORPORATION have accepted the tender of Crossley Motors, Limited, for the supply of a motor landaulette.

MOTOR TRAFFIC NOTES.

APPLICATIONS TO CLOSE ROADS.—Requests for the closing of roads to heavy motor traffic continue to be received by the Ministry of Transport from county authorities.

PNEUMATIC TYRES FOR OMNIBUSES.—In our issue of October 14 the Northampton Tramways Committee advertised for tenders for five omnibus chassis with alternative prices for solid and giant pneumatic tyres.

SPLASH GUARDS.—The Ministry of Transport have informed Rochester Town Council that they are not satisfied that efficient guards are on the market at reasonable prices, and that in these circumstances the Minister could not at present approve a by-law upon the subject.

SCOTTISH MOTOR EXHIBITION.—The 21st annual exhibition organised by the Scottish Motor Trade Association will be held in the Kelvin Hall, Glasgow, from January 26 to February 3, 1923. The show will be under the patronage of the Society of Motor Manufacturers and Traders.

Newcastle Corporation's Omnibuses at Hexham Abbey.

BATH CITY COUNCIL have purchased a Ford ambulance car for £216 15s. from the Kingsmead Motor Company, Bath.

BOURNEMOUTH PARKS COMMITTEE recommend the purchase of a motor chassis from the Hampshire Motor Company for £630.

LEEDS WATCH COMMITTEE have authorised the purchase of a new escape for the large Dennis motor fire engine at a cost not exceeding £300.

HALIFAX FIRE BRIGADE COMMITTEE have invited tenders for a fire engine to which the existing horse-drawn fire escape can be attached.

HALIFAX FIRE BRIGADE COMMITTEE have recommended the purchase of a standard Leyland motor fire engine and accessories at a cost of £1,966 10s.

PRESTON WATCH COMMITTEE have accepted the offer of Merryweather and Sons, Limited, for a new petrol engine to the motor fire engine for the sum of £400.

SOUTHWARK HEALTH COMMITTEE have recommended the purchase of a Hallford 30-cwt. chassis, with two detachable bodies, from Bayley, Limited, for £612.

SYDNEY (N.S.W.) MUNICIPAL COUNCIL are being asked to allocate £20,000 in next year's estimates for the provision of motor vehicles to replace horses and carts in cleansing and road maintenance work.

HALIFAX WATCH COMMITTEE have accepted the tender of the Vulcan Motor and Engineering Company, Limited, Southport, for the supply for £495 of a 20 H.P. light chassis, required for the conversion of a horsed ambulance to a motor ambulance.

SIDE CAR TAXIS.—Having inspected a motor cycle side-car taxi submitted by the County Cycle and Motor Company, the Bournemouth Licensing Committee have recommended that cars of their type, but slightly wider, be licensed, subject to the adoption by the Council of suitable regulations.

STANDARD SPECIFICATION FOR SPIRIT.—The British Engineering Standards Association have, at the request of the Automobile Association and the Commercial Motor Users' Association, appointed a representative committee to deal with the question of standard specifications in regard to the purchase of motor spirit.

TRAFFIC DANGER AND DAMAGE.—With a view to minimising danger to the public and damage to the roads, the Manchester Watch and Paving Committees are considering the question of the length, width, and construction of motor vehicles, and also the width to which loads may project beyond the width of the body.

NEWCASTLE CORPORATION OMNIBUSES.—At the conclusion of the conference of the Municipal Tramways Association in Newcastle in September, the members made an excursion to Hexham Abbey, travelling in motor omnibuses provided by the Newcastle Corporation tramways. The illustration on this page depicts ten of these vehicles lined up near the Abbey, which is seen in the distance. All the omnibuses made the return journey with complete success, taking the severe gradients which are found upon the route without the least difficulty. The general manager of the Newcastle Corporation Tramways, Mr. Ernest Hatton, is gradually developing his omnibus fleet, and the services in and about Newcastle are very popular.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

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SOME RECORDS OF ELECTRIC LOCOMOTIVES AND MOTOR CARS IN AMERICAN RAILWAY SERVICE.

By HOMER K. SMITH
(Railway Engineer, Westinghouse Electric and Manufacturing Company).

That the railroads of the United States, like those in the United Kingdom, have been passing through a very trying and very uncertain period is well known. Yet in spite of legislative restrictions, labour disturbances, and the difficulty of financing improvements, the leading railway managements are making serious efforts to improve their service, also their operating ratio, and to extend their facilities in order adequately to care for the volume of traffic anticipated. In many instances electrification is the tool which it is proposed to use for increasing the capacity of existing facilities, for improving the quality of the service, thus attracting greater patronage, and for reducing the operating expenses. Naturally there has been some scepticism among railway operators regarding this new tool, for electrification is comparatively new, even though it has been employed to some extent for many years. To secure the fullest advantages of electric operation frequently means some change in long established operating methods. These changes are to some extent required because of the greater reliability in service of the electric locomotive as compared with the steam locomotive. The latter has been developed until it is a most ingenious and reliable machine, so it has been with some reluctance that many railway men have conceded that the electric locomotive is more dependable in service. That electric locomotives and motor cars for heavy service can be depended upon is amply demonstrated by the following operating records of a number of railways that have adopted electric traction, among which are the following.

The Long Island Railroad was the first steam railroad in the United States to substitute electric for steam power on a large scale, the change being made on this road in 1905. Multiple unit cars with two 600 volt D.C. motors and a third rail contact system were adopted. Since electrification this road's passenger traffic has increased nearly 400 per cent., the freight traffic has increased nearly 200 per cent., and the earnings have increased approximately 200 per cent. There are 220 miles of electrified track and over 700 cars, of which approximately 80 per cent. are motor cars, now in operation. Over 200 cars are in service daily, and between 8 a.m. and 9 a.m. 32 trains are sent from Long Island through the west bound tunnel under the East River into the Pennsylvania terminal station on Manhattan Island, and during this period 26 trains are sent through the Flatbush terminus on Long Island. The annual passenger traffic is over 600,000,000 passenger miles. Some idea of the reliability of these large motor cars is shown by the fact that during

Multiple Unit Electric Train on Long Island Railroad with Third Rail Equipment.

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certain hours the schedules call for over 95 per cent. of the equipment being on the road.

The New York, New Haven and Hartford Railroad, with approximately 550 miles of electrified track, has a greater length of continuous electrified road than any other system in the world. In 1918 the passenger traffic density on this railway was second only to that of the Long Island Railroad. Single-phase electric locomotives are used for the through fast passenger and some of the local passenger service, for the fast time freight service, and for switching service. Multiple unit cars are used for some of the local passenger service.

In 1921 the electric passenger locomotives averaged 33,000 miles per locomotive failure, and the average detention per failure was 18 minutes. The mileage per locomotive was nearly 69,000. During the same year, with a comparatively light freight traffic, the freight locomotive mileage per locomotive failure was approximately 22,500. These locomotives frequently made two round trips between the Harlem River and New Haven in 24 hours, an aggregate mileage of 272. Under steam working the daily locomotive mileage in this section was from 100 to 120 miles. The New Haven has in operation 16 electric shunting locomotives. For a period of seven years—1915 to 1921 inclusive—these locomotives were in actual service over 70 per cent. of the total time, and during 1916 they were in actual service over 77 per cent. of the time. These locomotives are operated 24 hours per day, and they consistently make 140 miles per day (based on 6 miles per hour). It is a matter of record that the use of

Goods Train on New York, New Haven and Hartford Railroad with Single Phase Overhead Equipment.

Single Phase Passenger Locomotive—New York, New Haven and Hartford Railroad (Weight 175 Tons).

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Single Phase 80 Ton Locomotive Shunting in Oak Point Yards—New York, New Haven and Hartford Railroad.

these electric locomotives has resulted in a coal saving of 65 per cent. of that required for steam operation of this service, and they have replaced steam locomotives in the ratio of 2 to 1.

When it is borne in mind that the New Haven electrification is a pioneer one, that much progress has been made since these equipments were built, that more than half of the road locomotives on this system are seriously complicated because of the fact that they must operate with either A.C. or D.C. power supply, and furthermore that the records made in 1921 followed a period in which all motive power had been, for reasons beyond the control of the railroad, permitted to run down, it is seen that the records are remarkable.

The Pennsylvania Railroad in 1910 placed in service on their electrified extension into their New York terminal station thirty-one 600 volt third rail locomotives. These locomotives handle all of the main line passenger traffic into and out of the New York terminal, and from November 1910 to 1918 they made

Electric Locomotive (156 Tons) Hauling Passenger Train into Pennsylvania Station, New York City.

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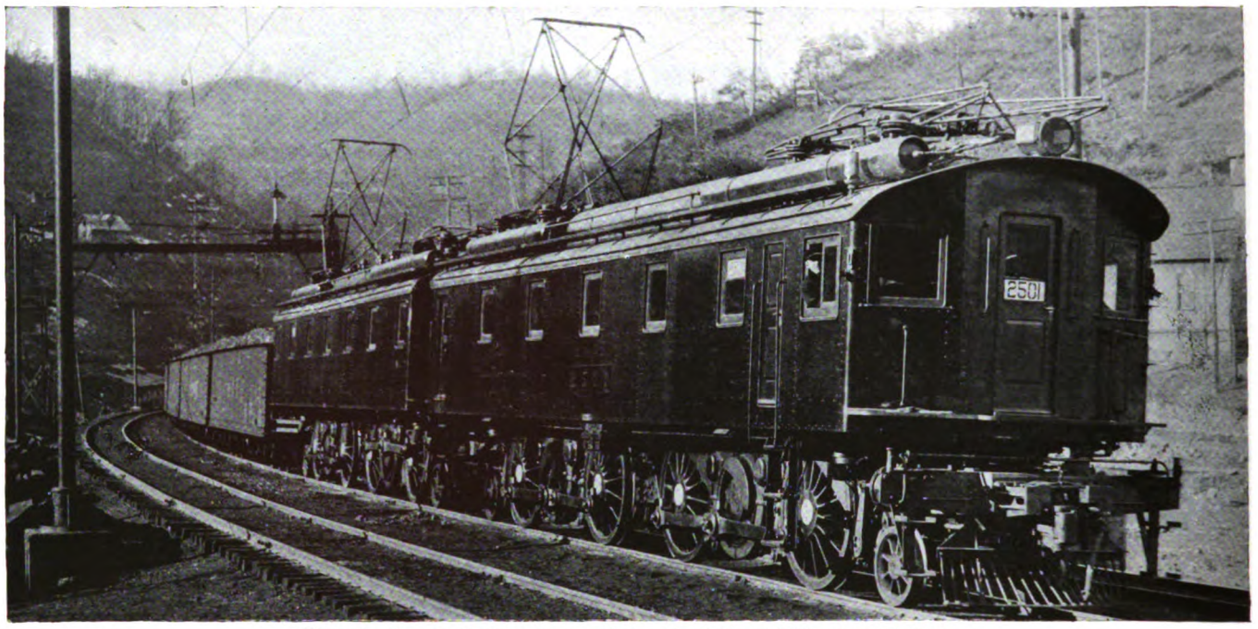
a total of 9,508,756 miles with a total of 121 engine failures, or an average of 78,600 miles per detention on account of locomotive trouble. During one year there was a total train delay due to failure of motive power of only 55 minutes. These locomotives are now averaging about 4,500 miles per month, and their maintenance is extremely low.

In a service where the average main line haul is short, and where there is considerable coal mine setting out and gathering service, as well as pusher service, these electric locomotives consistently do more than 100 miles per day. During the year 1920 they made an average mileage of 37,820. On account of there being so much shunting service, the actual mileage



Electric Goods Locomotives of the Norfolk and Western Railway.

The Norfolk and Western Railway electrification represents the most severe requirements that electrification has yet been called upon to perform. This road was the first to substitute electric for steam locomotives of the Mallet type for mountain grade service when their electrification, extending from Bluefield to Vivian, a route distance of 30 miles, was put into operation in 1914. The electrification zone has since been extended west approximately eight miles to Farm. This line has a double track throughout except for the 3,000 ft. Elkhorn tunnel. There is a considerable length of third track, side and yard tracks, and various branch or spur tracks to numerous coal mines along this section. With steam working trains of approximately 3,250 tons were hauled up the Elkhorn grade, with three of the most recent Mallet locomotives at a speed of 7 miles per hour. Two 300 ton electric locomotives haul the same trains on this grade at a speed of 14 miles per hour. Twelve electric locomotives were purchased to replace 24 Mallets, but by the time electric operation was started traffic had increased so that 33 Mallets would have been required. Since electrification was inaugurated the volume of traffic has increased enormously, but the twelve original electric locomotives are more than sufficient to handle the service.

Multiple Unit Train—New York, Westchester and Boston Railway.

was undoubtedly more than shown by the above record. The steam locomotives formerly used in this service averaged approximately 60 miles per day. The increased train speed and reduction in road delays obtained with the electric locomotives has, of course, greatly increased the track capacity. It has been stated by Norfolk and Western railway officials that this electrification has at least doubled their track capacity, as compared to steam operation. A recent notable achievement on this electrification was the handling of 90,000 tons of freight eastbound over the Elkhorn grade, and through the single track tunnel at the summit of this grade, in a single day.

An example of the successful application of heavy alternating current motor cars to dense traffic in exacting suburban service is that of the New York, Westchester, and Boston Railway, which operates local and express service from the Harlem River station of the New York, New Haven and Hartford Railway. The local trains make a schedule of 22 miles per hour with a stop every mile, and the express trains schedule speed is 37 miles per hour with an average distance of 2½ miles between stops. These equipments have proved their reliability in all kinds of weather. During the heavy snow storms of 1919-20, when the service on many steam roads was seriously demoralised,

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the operation of the suburban service on this road was 100 per cent. perfect. In 1919 the average mileage per car was over 42,000, and the average car mileage per minute of delay was over 2,700.

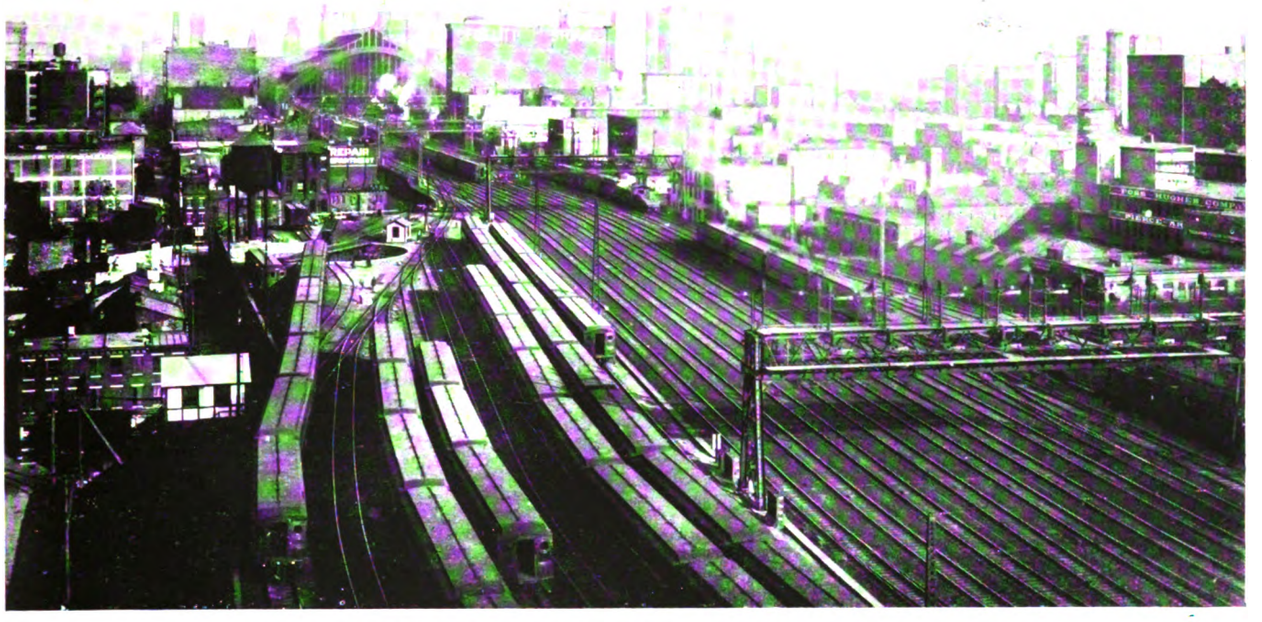
The Pennsylvania Railroad suburban service from the Broad Street terminus in Philadelphia to Paoli and Chestnut Hill represents what is undoubtedly the most severe congested traffic problem in American railroading. The Broad Street terminus is of the stub-end type, and there are sixteen tracks in the station, but at the interlocking tower controlling the entrance to this terminal there are only six tracks. In 1915 this terminal had reached the limit of its capacity of 160 trains per day with steam operation. The physical conditions were such that it was almost impossible to enlarge this terminus, and to increase its capacity electric operation of much of the suburban service with multiple unit cars was inaugurated. All cars are equipped with two alternating current motors on one truck, and trains are made up of from three to eight cars. The time required to bring a motor car train into the station and get it out again—including unloading and loading—is approximately one-third of the time required with steam operation. The track movements per train "turn-around" have been reduced from six to two.

Through the six-track bottle neck at the interlocking tower approximately 600 trains per day are now operated. Between 5 and 6 p.m. fifty trains pass this tower, and during one 17-minute period of this hour there is a train movement every minute. When it is borne in mind that this terminal had a capacity of only 160 trains per day with steam motive power, the improvement effected with electric operation is astonishing. However, with electric operation of all trains entering this terminal it is believed by many that the number of track movements could be made to so closely approximate the number of track movements that 1,000 trains per day could be handled, or approximately six times the capacity with steam operation. With electric operation the running time from Broad Street to Paoli—20 miles—has been reduced ten minutes. With steam operation 82 per cent. of the suburban trains were on time, while with electric operation the corresponding figure is 94 per cent.

During the year 1919 a total of over 2,883,000 car-miles were operated with an average of over 48,000 car-miles per detention. During one month of this year a total of 252,200 car-miles were operated with five detentions, totalling 14 minutes.

The Chicago, Milwaukee and St. Paul electrification is the only example of an extensive single track electrification of a trans-continental railroad. As is well known, the original installation covered 440 miles from Harlowton, Montana, to Avery, Idaho. On this section the Big Belt, Rocky and Bitter Root mountain ranges are crossed. With steam operation there were four engine districts on this section. The second installation extends from Oxethello to Seattle, Washington, a distance of 220 miles, and this section crosses the Cascade Mountains. The electrification of this road is unique in that its great transcontinental passenger service is handled by the most powerful passenger locomotives in the world, and furthermore because these locomotives are making mileages far in excess of any previous records. For the service on the 440 mile section from Harlowton to Avery, ten Baldwin-Westinghouse 3,000 volt D.C. locomotives with a one hour rating of 4,200 H.P., and a continuous rating of 3,400 H.P., were purchased. They have ample capacity to haul a 13-car all-steel train over the entire electrification zone without helper.

Soon after these locomotives were placed in service it was decided to run them through the entire 440 miles



Electric Trains Outside Broad Street Terminus, Philadelphia—Pennsylvania Railroad.

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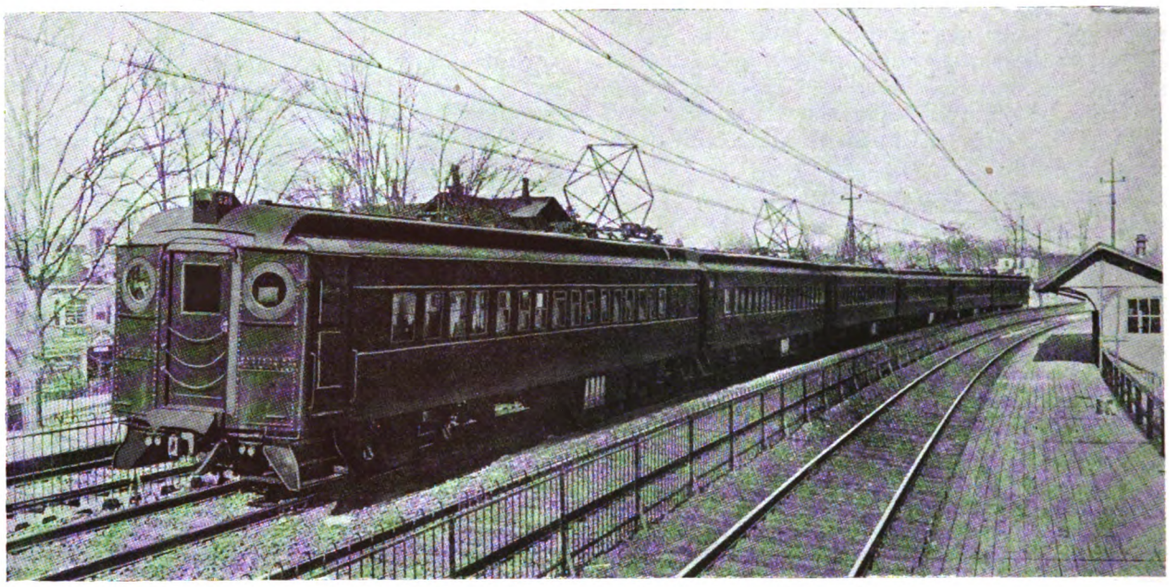
without turning in at Deer Lodge shops—near the middle of the electrification zone—for a general inspection, as had been the previous practice. This was a radical step, but the results obtained have certainly justified this plan of operation. The locomotives are given a light inspection at the end of the 440 mile run, and are sent to the main shops at Deer Lodge for a general inspection on a mileage basis of from 3,000 to 5,000. Two men at each terminus of electrification—Avery and Harlowton—take care of the light inspection. Individual locomotives in this service have made as much as 12,000 miles in one month. They have made the through run of 440 miles per day for twelve consecutive days during the most severe winter months. On the occasion of schedule derangement on the steam-operated sections of the road, these electric locomotives have been kept in continuous road service as much as 30 hours, and have made over 750 miles in a 24-hour period.

The substitution of electric for steam active power on the Chicago, Milwaukee and St. Paul Railroad has made it feasible to greatly simplify the operating organisation. The 440 mile section is now in charge of one superintendent with two sets of train despatchers, whereas with steam operation there were two division superintendents and four sets of despatchers. Eliminating intermediate engine terminals has, of course, simplified the mechanical department organisation also.



Multiple Unit Train—Pennsylvania Railroad, Paoli Branch.

No doubt there are individual cases of performance records of electric motive power more spectacular than those that have been given; there are also many other noteworthy railroad electrifications. Those mentioned above represent, however, all classes of heavy traction service which electrification will be called upon to perform. The records available leave much to be desired in so far as completeness is concerned; but it is a significant fact that the railroad officials responsible for such records as are available are most enthusiastic advocates of electrification.

Passenger Locomotive of 4,200 h.p. (Weight 275 Tons)—Chicago, Milwaukee and St. Paul Railroad (System 3,000 Volt D.C.).

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ELECTRIC LOCOMOTIVES FOR SOUTH AFRICAN RAILWAYS.

The decision of the South African Railways and Harbours Administration to electrify the section of their main line track between Glencoe and Pietermaritzburg, a distance of about 171 miles, has resulted in the contract for the supply of the locomotives being placed with the Metropolitan-Vickers Electrical Company, Limited, of Trafford Park, Manchester. These locomotives, of which 78 have been ordered, are designed to haul passengers and freight trains, and are so arranged that they can be worked alone or with other locomotives in multiple unit controlled by one driver. The conditions which have to be fulfilled by the locomotives are as follows—

(1) Three locomotives coupled together shall be capable of hauling a train weighing 1,800 short tons up a 1 per cent. grade at a speed of 21 to 22 miles per hour, and hauling the same train on level tangent track at 36 miles per hour.

(2) The locomotives shall be capable of running at a speed of 45 miles per hour without injury to any part.

(3) Three locomotives coupled together shall be capable of starting a train weighing 1,800 short tons on a rising gradient of 1:100 and attaining a speed of 22 miles per hour in three minutes.

(4) Three locomotives coupled together shall be capable of holding a train of 1,640 short tons on a falling gradient of 1 in 50 by regenerative action alone.

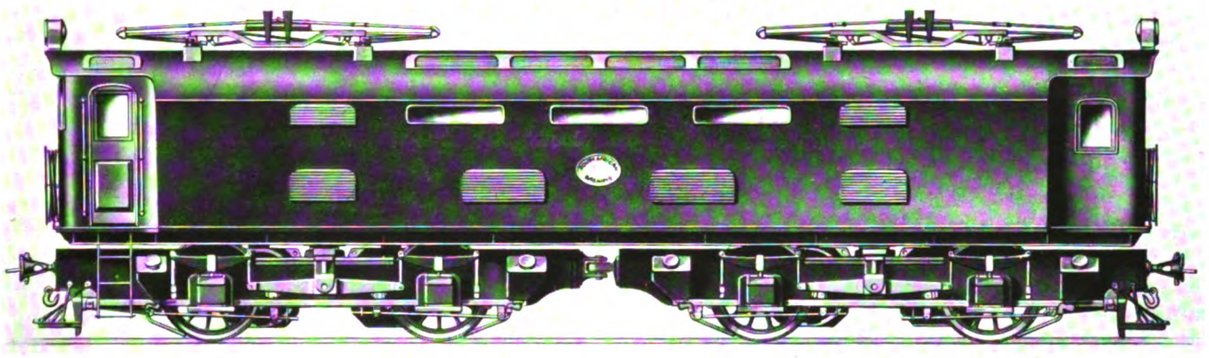
The normal duty which the administration will call upon the locomotive to perform is for three locomotives coupled together to haul a train weighing 1,430 short tons from Ladysmith to Pietermaritzburg, a distance of about 129 miles, in a little more than seven hours, and in the reverse direction a train weighing not less than 625 tons in about 7½ hours. The locomotives are to be capable of performing a round trip from Ladysmith to Pietermaritzburg and back under these conditions once every 24 hours for six days a week. The gradients on the line between these points are mostly in favour of the loaded trains, the ruling gradient against the load being 1 in 65 compensated. The ruling gradient for the trains returning from Pietermaritzburg to Ladysmith is 1 in 50 compensated. The loaded trains from Ladysmith to Pietermaritzburg have to travel down this gradient, which for trains in this direction is equivalent to an average gradient of about 1 in 55. There are, however, a number of lengths of tangent track on a gradient of 1 in 50. During one period of the journey from Ladysmith to Pietermaritzburg the loaded train has to be taken down a gradient about 15 miles long which includes a number of short lengths of 1 in 50 tangent track.

The maximum gradient on the section to be electrified is as much as 1 in 30 uncompensated, but these gradients occur on an old line which will principally be used as an alternative route in the event of the main line being blocked. Under these conditions the loads will be reduced to the capacity of the locomotives on this steeper gradient.

The locomotives, which are of the double bogie articulated type, consist of two four-wheeled bogies which are coupled together at their inner ends by means of a ball articulating joint, which allows free movement between the trucks. The draw and buffing gear is mounted directly on the bogies, thus ensuring that no undue strains are thrown on the locomotive body.

The main driving motors are carried on the bogies and are supported by suspension bearings on the axles, and nose supports on the bogie framing, and transmit their torque to the driving wheels by means of single reduction gearing.

Each bogie is equipped with two motors, thus the total weight of the locomotive is available for adhesion. Each motor is capable of developing 300 H.P. at the one hour rating, corresponding to a tractive effort of 5,800 lb. at 20·75 miles per hour; the tractive effort which the motor is capable of exerting continuously is 4,100 lb. at a speed of 22·5 miles per hour. Thus, the locomotive is capable of exerting 1,200 H.P. corresponding to a tractive effort of 23,200 lb. at the one hour rating, and a tractive effort of 16,400 lb. continuously. The maximum tractive effort which the locomotives are capable of exerting is about 43,000 lb. as determined by the adhesion between the wheels and the track. The motors themselves are capable of slipping the wheels of the locomotive under any conditions of rail.



Elevation of Electric Locomotive for South African Railways.

The body of the locomotive which is of the box type is carried on two cross girders which form the bogie pivots, and support the longitudinal girders of the body underframe. Roomy driving cabs are situated at either end of the locomotive, and each driving point is fitted with a controller driver's valves, and the usual gauges, whistles, and sanding switches, so that the locomotive can be operated equally well in either direction.

A gangway is provided on one side of the locomotive which allows of easy access between driving compartments. Trains may be hauled by a single loco-

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motive or by two or more coupled together, and arrangements have been made for simultaneous operation of the coupled locomotives by a single locomotive crew from the leading driving point.

The locomotive is designed to obtain current from an overhead trolley line supplying direct current at 3,000 volts. Current is collected by means of two pantograph current collectors. The control system is electro-pneumatic; all the control apparatus, together with the auxiliary machines and the main resistances, are mounted in the central compartment. This compartment is locked in such a manner that the driver is unable to enter until all apparatus has been made "dead," thus ensuring that there is no danger of the driver coming in contact with any high tension apparatus which is "alive."

A dual system of brakes is provided, an air pressure brake being used on the locomotive, and the vacuum brake for operating the train brakes, which are of the vacuum brake system. In view of the very heavy grades which are to be met with on the section of the line which is being electrified, the locomotives are arranged for regenerative control, that is, the motors during the period when the trains are descending gradients act as generators and return current to the line, at the same time holding the train at a steady speed without the use of the mechanical brakes. By this means not only is economy in current consumption effected, but the heavy wear on the brake blocks, which is experienced on long down grades, is avoided, together with reduced maintenance of the mechanical parts generally, owing to the absence of the strains which are thrown on to the locomotive during the braking period.

As a matter of interest, it might be pointed out that the brake system is so arranged that whilst the locomotive is regenerating the brakes on the train can be applied without applying the locomotive brakes; should, however, the brake application exceed a certain predetermined limit, then the regenerative action will be cut off and the locomotive brakes automatically applied.

The particulars and leading dimensions of the locomotives are as follows—

Weight in working order	... about 65 long tons
Weight of mechanical portion	... about 37½ long tons
Weight of electrical portion	... about 27½ long tons
Type of locomotive ...	... 0—4+4—0
Gauge	... 3 ft. 6 in.
Motor equipment	... 4—300 H.P. motors
Total motor rating ...	... one hour, 1,200 H.P.
Tractive effort	... one hour, 23,200 lbs., continuous 16,400 lbs.
Speed	... one hour 20·75 miles per hour, continuous 22·5 miles per hour
Control equipment ...	... electro pneumatic
Traction system	... 3,000 volts D.C.
Current collectors ...	... pantagraph trolley
Brakes	... dual fitted (air pressure for loco. vacuum for trains)
Length of body	... 40 ft. 8 in.
Overall height of locomotive	... 13 ft. 0 in.
Overall width of locomotive	... 9 ft. 2¼ in.
Diameter of driving wheel	... 4 ft. 0 in.
Wheel base of bogie ...	... 9 ft. 3 in.
Weight per driving axle ...	... 16¼ tons
Maximum safe locomotive speed	45 miles per hour

Mont Blanc Cable Railway.—The cable railway, which is driven by electric motors, from Les Bosnes in the Chamonix Valley to the summit of Mont Blanc is nearly complete, and it is expected that the service will be commenced next year. The upper terminus is at an altitude of 12,500 ft., and the journey will occupy about fifteen minutes.

RAILWAY AND ELECTRICITY SCHEMES.

Large Capital Expenditure Proposed.

There is good reason to hope that at length really important schemes for railway electrification will soon be undertaken, and that British railways will make up for years of comparative inactivity. It must not be forgotten that as long ago as 1904 the Lancashire and Yorkshire Railway, by the electrification for trunk line passenger service on their Liverpool and Southport Branch, made a departure which at that time had never been approached in magnitude or importance by any railway in the world. That their initial enterprise was not more extensively pursued or their example followed by other railways in this country was due to financial considerations that in the pre-war period of from 1900 to 1914 were suffered unduly, and, indeed, unnecessarily to hamper railway development.

With the reorganisation of railway enterprise, the consolidation of interests, and the more reasonable restriction of competition, the great railway groups are now recognising that electrification is not a speculation but the most assured and remunerative expenditure that they can undertake. A statement by the Minister of Labour in the House of Commons in the course of a debate upon the subject of unemployment on November 30 indicated that we are on the eve of extensive changes.

Sir Montague Barlow said that the directors and managers of the leading railway companies had responded in the most helpful way to the Prime Minister's appeal to press on with their development work. Without waiting for legal union, the railway companies had undertaken to make every effort to prepare and expedite their programmes. In outline the programme of work was as follows—

London and North-Western Railway, £2,000,000.
Eastern Group, £1,000,000.
Great Western, £1,000,000.
London and South-Western, £1,000,000.

Programmes involving £1,000,000 or £2,000,000 more were in contemplation, and the companies had further assured the Government that as the grouping proceeded they would be able to launch further development work.

Still more important, perhaps, than all these works were the proposals of the new Southern Group for electrification. The chairman-elect had promised not only to press on with the electrification of the South-Eastern and Chatham Railway, but also to extend the electrification to the London, Brighton and South Coast and the London and South-Western Railways. This expenditure would be effective in promoting not only direct but also indirect employment on a very large scale. These operations would be undertaken by the railways without any Government assistance at all, except in the one case of the South-Eastern electrification.

Electricity supply was another large field in which operations were in contemplation which would provide a great deal of employment both for unskilled workers and for skilled workers in factories. The Ministry of Transport and the Electricity Commissioners reported proposals for new power-stations or large extensions of existing power-stations at Barking, Deptford, Preston, Nottingham, and certain other places. The Grampians Electrical Power Company had an Act empowering them to construct big water-power works on the

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River Tay, and they also were seeking a guarantee under the Trade Facilities Act. These electrical schemes would involve operations totalling something like £10,000,000.

He appealed to leaders of industry for help, now that prices were becoming stabilised, to put in hand any big schemes of necessary work, and broaden out the basis of employment throughout the country. He believed he would not appeal in vain.

Important Developments of the London Underground Group.

Powers are being sought by the London Electric Railway, the City and South London Railway, and the Wimbledon and Sutton Railway to carry out a further scheme of development. About £3,500,000 is being spent upon the widening and modernisation of the City and South London Railway, which it is also proposed to extend in a south-westerly direction from Clapham Common via Balham, Tooting and Merton to Morden to form a junction with the proposed Wimbledon and Sutton Railway already authorised. In order to provide a West End connection for the City and South London Railway from the south, it is further intended to project the Hampstead line from its present terminus at Charing Cross to Waterloo, and thence to form junctions with the City and South London Railway at Kennington. Incidentally, junctions will be constructed south of Waterloo by means of which either the Hampstead line trains or the Bakerloo line trains can be projected to Kennington and thence on to the City and South London Railway's southern extension. Facilities will also be provided for the relief of the growing traffic at Waterloo Station.

The London Electric Railway Company recognise that the large increases in traffic to be brought by its prospective extensions into the centre of London will necessitate developments to the important central stations, such as Piccadilly Circus and Leicester Square. Powers will therefore be sought for the building of a new station at Piccadilly Circus under the roadway, with staircases giving access to all points in the Circus, and having escalators for the Bakerloo and Piccadilly lines. At Leicester Square the station will be doubled in capacity, and a new set of lift shafts sunk.

At Waterloo Station it is proposed to provide full interchange facilities between the Bakerloo and Hampstead lines and escalators, by means of which passengers may reach the street and the platforms of the South-Western Railway without trouble.

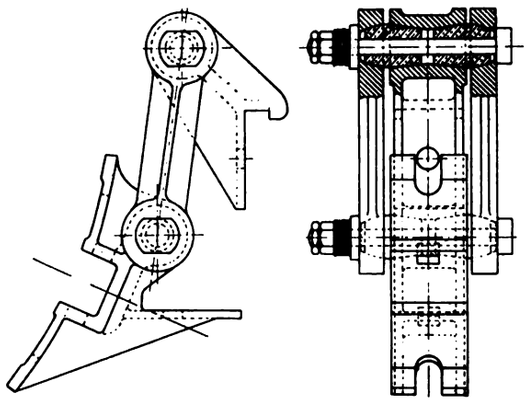
The total cost of the programme of works is estimated to fall between £6,000,000 and £7,000,000, and, with the expenditure which has already been incurred, will represent an expenditure on improvement to the Underground system of London amounting to nearly £17,000,000 since the war.

TRAMWAY PASSENGERS AND THE BELL.

In the course of an action by a tramway passenger for damages against the London County Council at Southwark County Court, His Honour Judge Sir Thomas Grainger suggested that it should be made an offence for a passenger to interfere with the bell of a tramway car. It was alleged that the conductor, who was on the top of the car, blew his whistle, with the result that the car started and a child fell. The defence was that the car was started because a passenger pulled the bell. Judgment was given for the defendants. It was intimated that the judge's suggestion would be conveyed to the London County Council.

BRAKE SHOE HANGER AND BRACKET.

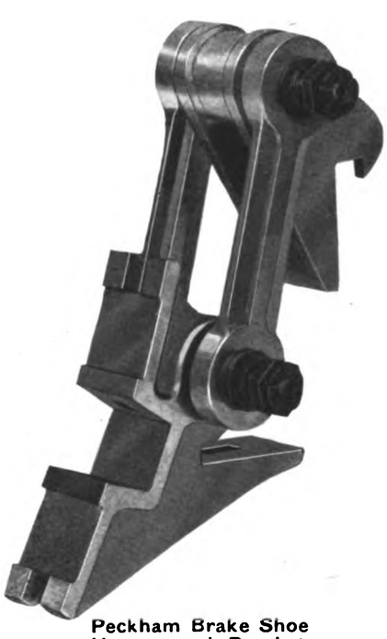
The Peckham Truck and Engineering Company, Limited, of Audrey House, Ely Place, London, E.C.1, have manufactured a brake shoe hanger and bracket which they claim will effect a large saving as compared with the ordinary type. As the cost of maintaining rolling stock is one of the most insistent difficulties



Side Elevation. Section.

that confront tramway managers, attention will no doubt be given to a device for which such a claim is made, particularly as the Peckham hanger has been thoroughly tested for a considerable period.

It will be observed that this patent brake shoe hanger is provided at each end of the hanger links with gun-metal conical bushes, which in turn are fitted into the brake hanger bracket and the shoe holder, which have spherical seating. All the wear takes place on these bushes, which can be replaced at considerably less cost than what would be necessary to replace the brake hanger link, brake hanger brackets, and the brake shoe holder.



Peckham Brake Shoe Hanger and Bracket.

The bolt which passes through the links is provided with a coil spring, which automatically takes up the slack and prevents the brake gear rattling. This is a point that managers will appreciate, as much of the noise on tramcars is due to the rattling of the brake parts. The bolts do not take any of the strain imposed on the links when applying the brake, but are used only to keep the links on to the bushes. The gun-metal bushes can be made from chill cast phosphor-bronze or gun-metal, and can be replaced in the car depot.

The Peckham Company are prepared to supply one or more sample sets of this gear for test purposes, and will be pleased to give any further information that may be desired.

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THE EDITOR will be glad to consider articles by experts. All information of a practical character relating particularly to the engineering and operating branches of transportation will receive prompt attention. Original illustrations will also be welcome.

LONDON, DECEMBER 14, 1922.

Electric Railway Extension and Employment.

Announcements made recently point to important and far-reaching developments in British railways. They are of special interest to all concerned in the promotion of electric traction and the manufacture of electric equipment and appliances. The electrification already extensively carried out on the London, Brighton and South Coast Railway and the London and South-Western Railway is to be continued, and the contemplated electrification of the South Eastern and Chatham Railways is to be put in hand very shortly. These enterprises are being expedited, following upon the Prime Minister's appeal to the companies to press on with their development work, and the promptness of the response reflects credit upon the directorate and management of the Southern Group Railways. It is worth noting that, except in the case of the South Eastern electrification, these schemes will be undertaken without any assistance being required from the Government. The London Underground Group's projects, which are partly in course of fulfilment, include extensions northward from Golders Green to Edgware, and southward from Clapham Common to Morden; the reconstruction of the City and South London Railway and the provision of a direct through running connection with the West End by means of a line from Charing Cross to Kennington; and additional and improved accommodation at several stations, including the building of what will be practically a new station at Piccadilly Circus. This programme, which involves an expenditure of something like ten millions of pounds, will be productive of a vast amount of employment in the workshops as well as at the places where constructional and equipment operations are actually proceeding. It should also be borne in mind that, in addition to the demand for skill, labour and materials arising out of the requirements of these schemes, there also follows a residential and business development of extra suburban districts provided with improved railway facilities. This implies the provision of new housing accommodation in hitherto relatively inaccessible localities, thereby contributing to the solution of the very grave problem of overcrowding in the more central areas. Thus a twofold benefit is conferred upon the community by the present activity in electric railway enterprise. Extensive operations are also contemplated in various places in regard to electricity supply, including the provision of new power-stations and the enlargement of existing stations, and in Scotland a water power scheme, the total outlay involved being estimated at something not far off ten million pounds.

A Crisis in the Commercial Motor Industry.

It is no exaggeration to say that the British commercial motor industry—an industry which is admitted to have contributed in no small degree to the successful termination of the war—stands at the present moment on the brink of destruction. Recent correspondence in *The Times*, in which Sir John Thornycroft and others have taken part, emphasises the more than serious nature of the position. It is clear that the industry is employing to-day not more than about 20 per cent. of the men employed three years ago. With hardly a single exception only those firms are at all busy, or are working at any profit, that have for one reason or another some special

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pull of their own. It may be, for instance, that they are fortunate in the possession of permanent contracts for the regular supply of vehicles to big Corporations, or that they hold something approaching a monopoly in some specialised type of machine for which there must still be a demand, even though trade is slack. Where some such special alleviating circumstances do not exist, the outlook is uniformly gloomy. The main reason for this condition, which has a serious influence on many other trades, is that those entrusted with the job of disposing of the Government surplus stores after the termination of the war showed no vision and no consideration. The problem presented to them for solution was immensely complicated by the need for doing something to rid the late Government of the incubus of Slough. Officials were so busy painting up a white elephant in bright and patriotic colours that they had no time to consider the future of essential industries. Neither could they possibly plead that the circumstances had not been brought to their notice. While the war was still continuing the industry was in touch for years with the authorities, constantly urging the seriousness of the imminent danger and proposing practical preventatives. Past experience, though on a smaller scale, was quite sufficient to prove conclusively that the only sound way of disposing of the surplus vehicles must be through the ordinary trade channels. The official, however, was perfectly certain that he knew more about how to do profitable business in motor lorries than did those who had for years been giving their whole time to this subject. It was imagined that a series of public auctions would solve the problem without going to the expense of giving the middleman a livelihood. Coupled with this theory was, as already stated, the necessity for white washing the Slough transaction. The result has been that the money realised by the Government out of the sale of vehicles has not been anything like sufficient to pay the doles to the unemployed of the commercial motor industry thrown out of work directly on account of the policy adopted. At this late date no good purpose will be served by analysing the various proceedings connected with Slough. It will suffice to remark that not even sufficient care was taken to ensure that sales would be effected at something approaching market prices, and that the Government would get at least a decent proportion of the total amount actually paid by the real ultimate user of the vehicle. The industry cannot now be saved by raking up old scandals, and the question is rather—what can be done? To a certain extent the position could be improved by eliminating or reducing foreign competition on the British market for the time being. It remains to be seen whether the present Government will feel itself capable of taking a somewhat stronger line in such matters than its predecessors. The Safeguarding of Industries Act is practically valueless in the case under consideration. The only effective step would be the imposition of a substantial import duty. So far as foreign markets are concerned, the competition of surplus vehicles is in general less serious, but competition with the foreigner must be faced as a rule on equal terms. By placing a duty on imports into Great Britain, our manufacturers would be enabled to increase their output. This means a reduction in overhead and other charges, which in turn implies ability to supply the overseas markets at lower figures. Thus indirectly the imposition of a tariff at home would accelerate the reconstruction of overseas trade.

Lighting and Ventilation in Tramway Cars.

At the present season of the year there are two subjects in regard to which dissatisfaction will sometimes arise in connection with even the best regulated tramway services. The days always close in early; sometimes they are semi-darkened even in the daylight hours. They are generally cold, or, if not, subject to sudden falls in the temperature. Hence the deficiency of lighting and the excess of ventilation of cars provide ample opportunities for complaint on the part of passengers. Not all these complaints are well founded. But there is a substratum of reasonableness about many of them, however much the reasonableness may be overlaid by the manner in which the complaints are too often expressed. In small towns the question of lighting, at any rate, does not matter so much, seeing that the

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passenger is not in the car for more than a few minutes. But in large tramway areas, where the regular traveller may spend, perhaps, two hours a day on his journeys to and from his place of work, the return certainly being made after dark has fallen, it is a matter of importance that he shall be able to read with a reasonable degree of facility while he is in the car. Yet this is sometimes impossible unless the reader has managed to secure a seat just under a lamp. Tramway operators should recognise the importance of a satisfactory method of interior lighting in the cars on their systems, as far as may be economically practicable. The question of ventilation is on rather a different footing, seeing that, given the best ventilating arrangements, such as those on the cars supplied for service on the London County Council system, the problem is complicated by the difficulty of steering between too much and too little—between the point of view of the passengers who complain of draughtiness and that of those whose grievance is the stuffiness of the cars. Here a great deal depends, as often, on the alertness and common sense of the conductor. The conductor on a crowded urban car is, however, a busy and at times hard-pressed individual, and ventilation must take a back seat in his mind while fares have to be collected. The best procedure during the winter months would probably be for the large side windows on the upper deck to be open not more than a foot from the roof—sometimes, perhaps, less. Inside the car windows should be kept closed, but the ventilators, whether of the fanlight or the opening outward sideways variety, should be kept more or less open. The problems of lighting and ventilation are not always easy of solution, but they are worthy of more attention than is sometimes accorded to them, in the interests both of the public and of the operators of tramways.

The British Thomson-Houston Co. Ltd., and Armstrong, Whitworth and Co. Ltd.—Arrangements have been made by the British Thomson-Houston Co. Ltd. and Sir W. G. Armstrong, Whitworth and Co. Ltd. to undertake jointly the complete electrification of railways, and the manufacture of all types of electric locomotives and rolling stock. These arrangements have no doubt been entered into with a view to the prospect of railway electrification being undertaken on an extensive scale at an early date. The locomotives and rolling stock would be constructed at the works of Armstrong, Whitworth and Co., while the British Thomson-Houston Co., at their works at Rugby, would provide all the necessary electrical equipment and machinery both for the electric locomotives and the rolling stock, and for power-station and sub-station equipment.

BIRMINGHAM'S ILLUMINATED CAR HELPS UNEMPLOYED.

The Birmingham Corporation tramways department have taken an active part in assisting the Lord Mayor of Birmingham's Unemployment Fund. Beginning on Monday, November 27, an illuminated and handsomely decorated car, bearing in large letters the words "Lord Mayor's Distress Fund: Please Give Freely," traversed the routes on the southern section of the tramways system. Whenever it was possible, without interfering with the ordinary service, the illuminated car was allowed to stand for a while to enable spectators to obtain a better view of it. During these pauses in its journey the tramways band, which accompanied the car in a motor vehicle, played selections, and employees of the department in fancy dress took up a collection from the public. In this way a sum of £1,380 was collected during the week in aid of the Lord Mayor's fund. The tramway men, who have done this work in their own time, have worked wholeheartedly, and their zeal, says Mr. A. Baker, the general manager, has been rewarded by obtaining such a magnificent result. Mr. Baker proposes after a short interval to arrange for the car to run over the remaining three sections of the system, and it is hoped that the response from the public will be equally satisfactory. The Lord Mayor's fund has also been helped by the sale of penny tickets on the cars; and the proceeds from this source realised over £800 during the month of November.

LONDON UNDERGROUND FARE REDUCTIONS.

The Underground Group of Companies intend to carry out a scheme of reductions in fares on their tramways and omnibuses. It is proposed to restore the popular penny fare by giving two stages instead of one, as at present, for this fare. This will involve consequential alterations in many other fares, which are now being worked out in detail. The existing stage points, with a few exceptions, are being retained to prevent inconvenience. On the Underground Railways it is proposed to retain the initial 1½d. fare, but to reduce the fares above that amount to an approximate rate of 1d. per mile up to 4d., and thereafter to increase the distance given for all rates of fare above 4d. It is hoped that this will tend to encourage the long-distance traffic and to stimulate the growth of the healthy outer suburbs.

In accordance with the principle laid down in the London Electric Railway Fares Act of 1920, the workman's fare return will be the single ordinary fare for the double journey; so that, where the ordinary fare is reduced, the workmen will get a corresponding reduction, subject to the minimum return fare remaining at 3d. Season ticket rates, where these have been based upon the present ordinary fares, in accordance with the scale commonly employed, will be reduced in accordance with the new ordinary fares. The reductions outlined affect one-third of the present railway fares, and almost one-half of the present omnibus fares outside the London County Council Tramways area. The Underground group have not in the past charged fares at anything like their full statutory powers on the average, and, when the reductions are carried out, they will be charging appreciably less than 1d. per mile.

Position of London Transport.—Sir Henry Maybury, Director-General of Roads, Ministry of Transport, giving evidence before the Royal Commission on London Government, said that during the last two years the traffic situation of London had very much improved. More omnibuses, additional trains and tramcars had greatly relieved the congestion existing just after the armistice. The improvement had caused him to modify his view in regard to the advisability of establishing a Traffic Board for London. He now favoured the appointment of a London Traffic Committee of not more than fifteen members, to advise and assist the Ministry of Transport or such department as took over its duties. The traffic area dealt with should be that within a radius of twenty-five miles from Charing Cross. There would have to be some co-ordination in the public interest of all passenger transport agencies. At present there were competing services, which resulted in loss to all parties.

Railway Companies' Staff.—This return (price 1s.) issued by the Ministry of Transport shows that the total staff employed by the railway companies in Great Britain during the week ended March 25, 1922, was 675,802, a decrease of 59,068, or 8·03 per cent., as compared with the corresponding week of the previous year. The decrease in the number of women employees was 3,965, or 14·5 per cent. A comparison of the rates of pay of certain selected grades of male adult railway staff on January 1, 1921, and July 1, 1922, is included in the return.

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THE ELECTRICITY COMMISSIONERS AND THEIR WORK.

The powers and duties of the Electricity Commissioners, the new Legislation passed in August last, and the work which has so far been done by the Commissioners are indicated in the following article. The vital effect which the Electricity (Supply) Act will ultimately have upon the development of Electric Traction is as yet but inadequately appreciated even by those immediately concerned.

The Electricity (Supply) Act received the Royal Assent on December 23, 1919, and the Electricity Commissioners were appointed in accordance with its provisions on January 23, 1920. The Commissioners are Sir John Snell (chief commissioner), Mr. H. Booth, Mr. W. W. Lackie, Mr. Archibald Page, and Sir Harry Harwood.

When the Electricity (Supply) Bill, as it then was, was before the House of Commons in 1919, many of its proposals met with strong opposition. This applied in particular to compulsory powers contained in it for the setting up of district electricity boards all over the country. The root of the opposition was objection to State control of the industry—for this, it was contended, was what the Bill would entail. The Government, to meet the point, made amendments to provide as an alternative voluntary joint electricity authorities. The Bill, still subject to much opposition, was passed through the Commons late in the session, and when it went to the House of Lords it was met by a storm of criticism. It speedily became apparent that in the month of December it was impossible to get the Bill through in that session unless it was radically altered. The Government accordingly threw over all the compulsory powers in the Bill, including those relating to district boards, and the whole scheme became a voluntary one, the word "may" taking the place of "shall" almost throughout. Unfortunately the financial provisions (as to raising capital) had also to be abandoned. The Government announced that they would in 1920 reintroduce the dropped proposals, as they considered them necessary for a national scheme of electric power development, but they never found the opportunity to do so. Instead, they brought before Parliament in 1920 an Electricity (Supply) Bill of more limited scope, its main object being to enable joint electricity authorities to raise money for the execution of their work.

Neither in 1920 nor in 1921 did the Government press forward this Bill, and it lapsed at the end of each session. In 1922, however, they introduced it again, this time in the House of Lords, and they succeeded, after long debates and numerous amendments in details, in passing it through both Houses, and it received the Royal Assent on August 4. Many of the amendments were of a limiting character, but the main features of the Act remain.

The Act of 1919 opens by providing that for promoting, regulating, and supervising the supply of electricity there should be established a body to be called the Electricity Commissioners, not exceeding five in number, to be appointed by the Board of Trade. (All powers and duties of the Board of Trade under the Act are, however, by a later clause transferred to the Ministry of Transport.) It was also provided that three of the Commissioners should be selected for practical, commercial, and scientific knowledge, and wide business experience, including that of electrical supply.

REORGANISATION OF SUPPLY.

To understand exactly what the Commissioners are doing, and what they may yet do, it is desirable to summarise the main provisions of the Act of 1919, bearing in mind that its whole object is to secure a cheap and abundant supply of electricity for all purposes throughout the country. Accordingly, it may first be noted that the Commissioners may provisionally determine that any district in the United Kingdom shall be constituted a separate electricity district. Areas are to be grouped in the manner most conducive to efficiency and economy. Before finally determining the area of any district, the Commissioners are required to publish a notice, and if any objection or representation is received they must hold a local inquiry. Where it appears to the Commissioners that in any district provisionally determined the existing organisation for the supply of electricity should be improved, they are to hold another local inquiry, and they shall give to authorised undertakers, county councils, local authorities, railway companies using or proposing to use electric traction, large consumers of electricity, and other bodies in the district interested, an opportunity to submit a scheme or schemes for effecting the improvement. If no scheme is submitted within the time allowed, or if no scheme submitted is approved by the Commissioners, the latter may formulate a scheme.

A scheme may provide for the establishment, and, where desirable, the incorporation of a joint electricity authority representative of authorised undertakers within the district, with or without the addition of representatives of county councils, local authorities, large consumers, and other interests, and for the exercise by that authority of the powers of the authorised undertakers, and for the transfer to the authority of the undertakings of any of the undertakers on terms provided by the scheme. No transfer of an undertaking can be made except with the consent of its owners.

The Commissioners may make an Order embodying decisions they arrive at as the result of the inquiry, and present the Order for confirmation to the Ministry of Transport. After it is confirmed the Order is to be laid before both Houses of Parliament, and it is not to come into operation until it has been approved by a resolution passed by each House.

DUTIES AND POWERS OF JOINT ELECTRICITY AUTHORITIES.

It will be the duty of every joint electricity authority to provide a cheap and abundant supply of electricity within their district. Their powers will include the construction of generating stations, main transmission lines, and other works, and the acquisition of the undertakings of authorised undertakers by agreement. No body may establish a new or extend an existing generating station or main transmission line without the consent of the Commissioners. A joint electricity authority will have power to supply electricity within their district, subject to two limitations. The authority shall not supply electricity in any area which forms part of the area of supply of any authorised distributors without the consent of these distributors, except to railway, canal, or inland navigation companies or authorities for the purpose of traction. The other limitation is that the authority is not to supply electricity in any part of the area of supply of a power

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company for any purpose for which the company are authorised to supply, without the consent of the company. The consent, if unreasonably refused, may be dispensed with by the Ministry of Transport.

The Ministry of Transport is authorised, after a district has been provisionally determined, and before the establishment of an authority, and for two years afterwards, to construct any generating station, main transmission line, or other works, and exercise any other powers of the authority. For such purposes the Treasury are empowered to issue to the Ministry of Transport any sums not exceeding £20,000,000. The works will afterwards vest in the authority, subject to repayment by the latter of the advances. Various detail powers of the electricity authorities need not here be entered on.

As to finance, every joint authority is to establish a fund to which all receipts by the authority shall be carried, and out of which all payments by the authority shall be made. The authorities are to pay, in proportion to their electrical output, contributions towards the expenses of the Commissioners.

For the provision of capital to enable the joint authorities to establish their undertakings, the original Act for reasons already stated made no provision, but the Act of 1922 makes good that defect.

THE AMENDING ACT.

The leading feature of the Electricity (Supply) Act 1922, is that it empowers joint electricity authorities to borrow money for the purpose of the payment of the cost of generating stations, main transmission lines, and other works, and for the purpose of providing working capital. A scheme constituting a joint electricity authority shall fix the maximum amount which may be borrowed by the authority, but excess borrowing may be authorised by the Electricity Commissioners if confirmed by Parliament. The Commissioners may empower the authority to issue stock which may be used for making payments. Authorised undertakers, local authorities, and companies are empowered under certain conditions to give financial assistance in various forms to the joint authorities. Authorised undertakers may lease their undertakings to the joint authorities.

There are several points in the new Act indicating that the joint electricity authority is not necessarily to be a monopolist in its area. Such, for example, is the provision that where a generating station or main transmission line is transferred to such an authority the latter may agree with the former owner that that owner shall work and maintain it on agreed terms. Further, the powers and duties of a joint authority may be exercised and performed by the joint authority, or, if so authorised by special Order, through any authorised undertakers. Following on this are details as to maximum charges and so forth.

Important from the traction point of view is a clause making it permissible for the owners of any railway or tramway generating station, with the consent of the Commissioners, to supply electricity on agreed terms to a joint electricity authority, to an authorised undertaker, or to any consumer.

At the report stage of the Bill in the House of Commons several new clauses were added to the Bill. One of these is of special value to railway and tramway undertakings. It provides that, notwithstanding anything contained in any Act or Order, electricity supplied by a joint electricity authority or power company within their district to any company or authority who are the owners or lessees of a railway, tramway, dock and harbour or canal undertaking may be used by the company or authority receiving the supply for the purpose of traction or for lighting their vehicles or vessels on any part of the system of such company or authority. This enables the railway or tramway undertaking to use the electricity outside the area of supply of the supplier, and the necessity of such freedom is obvious.

Other new clauses adopted related to protection of electric power companies and points of detail. Generally it may be said that the amendments adopted in both Houses of Parliament were in the direction of limiting or hedging round with safeguards the provisions of the Bill as it originally stood.

THE WHOLE POSITION.

It will be seen that the whole scheme is of an elastic permissive character. It is a substitution for the compulsory national scheme that was originally brought forward by the Government.

Pending the passing of the 1922 Act, the Electricity Commissioners had proceeded as far as they could with their appointed task. A summary of what they have done to date follows. It may also be noted that the prescribed procedure is so elaborate and so hedged round that rapid progress could not be expected for some time until experience smoothed the path.

A condition which may in some cases lead to delay is that an Order by the Commissioners can only become operative after it has been approved by a resolution passed by both Houses of Parliament. Time has to be found for passing such resolutions if they are opposed. The ordinary course with regard to Orders, regulations, and so forth made by Government departments in pursuance of statutory powers is that they shall lie on the table of each House for so many days, and that if within that period no resolution is passed against them they become operative. That is a different and much more simple arrangement. But throughout the consideration of the whole electricity supply scheme Parliament showed an unusual determination that the powers to be entrusted to the Electricity Commissioners should be closely supervised, and as limited as was consistent with the purposes to be attained.

THE WORK SO FAR DONE.

It may appear that considering the time they have been in existence the Commissioners have not accomplished great things. But in addition to the hampering nature of the defective Act of 1919, it must be recognised that time was required to explore the country so as to ascertain the existing electric supply, the best methods of grouping, and the best division into electricity districts. Down to date the Commissioners have provisionally determined 15 districts, namely,

East Midlands.	North Wales and Chester.
East of Scotland.	North-West Midlands.
London and Home Counties.	South-East Lancashire.
Lower Severn.	South Wales.
Mersey and West Lancashire.	South-West Midlands.
Mid-Lancashire.	West Riding (Aire and Calder).
North-East Midlands.	West of Scotland.
North Lancashire and South Cumberland.	

The Lower Severn scheme has not been proceeded with owing to changed circumstances in the district.

First local inquiries have so far been held in the following five of the above cases, and draft schemes have been issued and are being considered by parties pending second inquiries—

London and Home Counties.	North-West Midlands.
Mersey and West Lancashire.	North Wales and Chester.
West Riding (Aire and Calder).	

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A first inquiry was also opened in regard to North Lancashire and South Cumberland, but the Commissioners found that from engineering and economic points of view the district is too scattered for immediate development under the control of a joint authority, and that no practical advantage would accrue from the formation of such an authority at the present time. The Commissioners are, however, prepared to consider proposals for improvements in certain parts of the districts. In the case of the North Wales and Chester District the joint electricity authority proposed by the scheme is to have part of its powers transferred to the North Wales Power and Traction Company. In the cases of London, Mersey, North-West Midlands, and West Riding, the draft schemes propose the constitution of joint authorities in the ordinary way.

Two of the other cases are still further advanced, the second inquiries having been held, and the draft Orders issued. These are the South-East Lancashire and the South-West Midlands districts. In the former case the Order constitutes the district and establishes the South-East Lancashire Electricity Advisory Board, and in the latter case the Order constitutes the district and establishes the South-West Midlands Advisory Committee. The board in the one case and the committee in the other take the place of the joint electricity authorities provided for permissively in the Act of 1919. The two Orders, it is hoped, will be presented to Parliament for confirmation before the end of this year. When so confirmed they will come into operation, and will be the first of their kind.

The wisdom of setting up these advisory bodies instead of joint electricity authorities is evidently somewhat dubiously regarded by the Commissioners, but the course has been adopted in deference to the strong opinion in the districts concerned. In the South-East Lancashire draft scheme, for example, the Commissioners say that they entertain some doubt as to whether the provisions by which the Advisory Board will make representations to constituent authorities with a right of appeal to the Commissioners, whose decision (within strictly defined limits) will be binding on the constituent authorities, will enable sufficiently comprehensive works to be undertaken. The number of members of the board (representing various authorities and companies) is, it may be noted, no fewer than 50, so that it is quite possible that difficulties may arise. In this case, as in that of the South-West Midlands Advisory Committee, these advisory bodies are to make recommendations to the constituent authorities, and in each case technical schemes for the improvement of supply, which have been approved by the Commissioners, are to be carried out. The advisory committee looks more hopeful than the advisory board, as it is to have only four members. The similarity between the position of these advisory bodies and that of joint electricity authorities is that in each case there are powers of regulation and decision vested in the Electricity Commissioners. Otherwise, however, the joint authority would seem to be the more efficient instrument.

The various schemes and Orders under way provide for the formation of technical committees and for the carrying out of technical schemes of development approved by the Commissioners.

In that connection it is of some importance to note the provisions in the two draft orders already mentioned which set up advisory bodies. In future Orders constituting joint electricity authorities it may be assumed that these authorities will be directed to carry out the technical schemes. In the case of the South-West Midlands district, it is not the advisory committee but constituent authorities, namely, Birmingham Corporation and the Shropshire, Worcestershire and Staffordshire Electric Power Company who are to secure the provision of a cheap and abundant supply of electricity, to carry into effect the technical scheme, and to be severally responsible for the capital expenditure in their respective areas in the district. In the case of the South-East Lancashire district, on the other hand, it is the advisory board which is to carry out the scheme of development, and it is to consider proposals for new works by the constituent authorities and make recommendations to them and to the Commissioners. The latter will decide on appeals from the constituent authorities.

Within the limits of this article it is not possible to outline the various schemes under consideration. In general it may be said that they show great variety, and are framed after minute investigation of all local circumstances and requirements, and with a view to bringing about the best results. The two draft Orders about to be submitted to the Legislature are as detailed and precise as private Acts of Parliament. No time nor labour has been spared, and one general result aimed at is as far as possible to bring about agreement among all the parties concerned. The London and Home Counties scheme may be mentioned as an example of dealing with a specially complicated problem such as that of the Metropolis. It is a comprehensive and far-reaching design, applicable not merely to the present time but to the anticipated great developments of the future.

POWER SUPPLY FOR RAILWAY COMPANIES.

Reference should be made to the important decision of the Electricity Commissioners, promulgated in the end of September 1922, on the application by the South-Eastern and Chatham Railway Company for sanction to erect a generating station for working their suburban lines electrically. The decision has been reported in a previous issue, but the point may be briefly mentioned here, as it is of great general importance. It is based on Section 11 of the Electricity (Supply) Act, 1919, and on the proviso to it. That section lays it down that it shall not be lawful for any authority, company, or person to establish a new or extend an existing generating station or main transmission line without the consent of the Commissioners. In the proviso, however, it is stated that in the case of a railway company using or proposing to use electricity for traction consent shall not be refused unless it is proved that a joint electricity authority or authorised undertakers are or will be willing and in a position to give the railway company a supply of electricity adequate in quantity and regularity to meet the present and prospective demand of the railway company at a cost not greater than would have been incurred by the railway company in supplying themselves. The Commissioners found that there were authorised undertakers in the district who would be able to fulfil these conditions by the time required, and they accordingly refused sanction for the proposed station. They also dwelt on the importance of pooling demands and of a general supply for all purposes, and they viewed the matter in the light of coming concentration of power supply for Greater London. The latter point is also dealt with in the draft scheme for the London district already referred to.

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In addition to the work of the Commissioners outlined above, they are continually carrying on a mass of routine work transferred to them from the Board of Trade, the Minister of Health, the Secretary for Scotland, etc. For example, there are the consideration of applications for ordinary electric lighting orders, the sanction to borrowing by local authorities under the Electric Lighting Acts, the advising of the Minister of Transport in the exercise of his powers and duties under the Electricity (Supply) Acts, the granting of consent in certain cases for new generating stations, and the carrying out of a number of other statutory miscellaneous duties.

Some indication has thus been given of the important work which the Commissioners are carrying out. Their indefatigable secretary is Mr. R. T. G. French.

RAILWAY CROSSINGS FOR HEAVY SERVICE.

Railway engineers to-day have many difficult problems to face, but perhaps none are more worrying than the maintenance of the track at busy and important centres, so that they will be interested in the following results that have been achieved by the adoption of Hadfield's "Era" manganese steel (patented) for special positions in permanent way carrying frequent and heavy traffic.

Many years ago the Pennsylvania railroad officials reported that crossings of "Era" manganese steel, made under the Hadfield's system and patents, lasted from twelve to fifteen times longer than the ordinary steel crossings, and proved more satisfactory in every way. Some of the crossings under notice were situated on a track used almost exclusively for high speed passenger trains, and they remained in continuous service for four years and forty-seven days, whilst the life of ordinary steel crossings in the same positions was not more than three months.

The first users of "Era" manganese steel for railway permanent way in this country were the Underground Railways of London, and three years after some of Hadfield's crossings were laid down, notwithstanding the fact that two hundred and eighteen million tons of traffic had passed over them, these crossings showed scarcely any wear at all. The total average life of the crossings was ten years, which gives a grand total of 730 million tons of traffic passing over them during that period, whereas the ordinary apparatus used before the installation of "Era" manganese steel never lasted more than six weeks or two months; consequently they were beyond further service after 12 million tons of traffic had passed over them.

Other illustrations of the remarkable durability of Hadfield's patent "Era" manganese steel under the severest working conditions are the High Level Junction, Central Station, Newcastle-on-Tyne, and the Forth Junction, Newcastle-on-Tyne. The former consists of no less than 77 intersections in a total of 92 castings, and the total area covered is 6,520 square feet. The weight of the castings before despatch was 60 tons, and the junction is one of the busiest in the country, carrying as it does passenger and goods traffic between London and Edinburgh. The layout was installed in November 1912, and it is still in service. The Forth Junction, however, has been in service since October 1904, under an average daily traffic of 170,000 tons, and as the majority of the crossings are still in service no less than 1,117 million tons of traffic have passed over them. These are two striking examples of durability which, it is claimed, cannot be equalled.

The foregoing remarks apply particularly to the solid type of manganese steel crossing, but switches and crossings made from rolled "Era" manganese steel rails can be built up to the railway company's standard design, like those from the ordinary steel rails. An illustration of this type of construction is the Primera Junta Station Junction supplied by Hadfields to the Buenos Ayres Subway. It needed 160 tons of rails to complete it, and it is the largest example of rolled manganese steel work in the world, and as Hadfields have just installed an up-to-date electrically driven 28 in. rolling mill, they are now in a position to attend to their own rolling requirements, so that all the processes of manufacture and treatment can now be carried through in their own works under the supervision of their own expert staff. This is an immense advantage, as the ultimate success of the rails, switches and crossings is largely dependent on efficient treatment after manufacture.

Group of Rails which were bent under Tup Weighing 20 cwt. Dropped 20 ft., showing Toughness of Era Manganese Steel.

The accompanying illustration will be interesting to those who have had no experience of "Era" manganese steel, as it shows that although it is extremely hard, it is excessively tough, and can be bent with the same facility as ordinary steel, but it cannot be machined, so that all finishing has to be done by grinding on machines specially designed for the purpose.

Whilst these notes deal with the suitability of "Era" manganese steel for railway service, it should not be overlooked that this special steel is equally successful

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in electric tramway service; in fact it would be difficult to name a tramway system to-day that has not adopted "Era" manganese steel for its points, crossings, and special work.

FINANCIAL REPORTS AND MEETINGS.

INDIAN ELECTRIC SUPPLY AND TRACTION CO.—An interim dividend of 3 per cent. on the ordinary shares is announced.

CHLORIDE ELECTRICAL STORAGE COMPANY announce an interim dividend on the ordinary shares of 5 per cent., free of tax.

COVENTRY CHAIN COMPANY announce a dividend of 4½ per cent., less tax, on the ordinary shares, making 7½ per cent. for the year.

ELECTRIC SUPPLY CORPORATION announce an interim dividend at the rate of 6 per cent. (less tax) for the half-year to June 30, 1922.

DENNIS BROTHERS, LIMITED.—A final dividend for the year of 7 per cent. and a bonus of 3 per cent, both less tax, has been announced.

BRITISH ELECTRIC TRACTION COMPANY have declared an interim dividend of 2 per cent. on the ordinary shares. Last year there was no interim distribution.

ELECTRIC CONSTRUCTION CO. LTD.—An interim dividend of 7 per cent. per annum on preference shares, less tax, and of 6 per cent. per annum on ordinary shares, less tax, has been declared.

AUCKLAND ELECTRIC TRAMWAYS.—Report for the year ended June 30, 1922, shows balance on revenue account of £33,208, making, with brought forward, a total of £41,699. Dividend on ordinary shares is at the rate of 5¼ per cent. for the year, free of tax, £9,074 being carried forward.

EAST INDIA TRAMWAYS.—The profit for the year to July 31 was £6,894. Dividend was 5 per cent. on ordinary shares and 7½ per cent. on deferred shares, less interim dividends of 2½ per cent. already paid. To reserve and renewals £1,500 was placed, leaving £337 to be carried forward.

JOHN I. THORNYCROFT AND COMPANY, LIMITED.—The directors recommend a dividend of 3 per cent. on the preference shares, making 6 per cent. for the year ended July 31, 1922, and 7½ per cent. on the participating preferred ordinary shares, carrying forward the sum of £60,758.

SIEMENS BROTHERS AND CO. LTD., recently announced that they were unable to declare an interim dividend on the ordinary shares. For the corresponding period of last year an interim dividend of 1s. per share was paid, which was made up to 10 per cent. for the whole year, free of tax, by a final dividend of a like amount.

ADELAIDE TRAMWAYS TRUST.—The report for the half-year ended July 31 last shows that the revenue amounted to £291,808, while the operating expenses were £202,173, leaving a balance of £89,635. After providing for reserve for renewals, £11,381, interest, payment to the Government off their advance for construction, and interest on purchase money for horse car systems, there was a net surplus of £10,938.

NORTH MELBOURNE ELECTRIC TRAMWAY.—The directors of the North Melbourne Electric Tramways and Lighting Company, in their report for the year ended September 30, 1921, state that their undertakings have been sold to the State Electricity Commission of Victoria as from August 1, 1922. When the audited accounts arrive from Australia a final balance sheet will be prepared and submitted to shareholders in due course.

BROWN, BAYLEY'S STEEL WORKS, LTD.—The report for the eleven months ended July 31 last states that there was a loss of £66,884. After deducting £20,040 brought in, there remains a debit balance on revenue of £46,844. The rapid fall in prices, general lack of confidence, almost complete absence of export trade, combined with the engineering lock-out, are stated by the directors as reasons for their not being in a position to recommend the payment of any dividend.

STRAKER-SQUIRE, LTD.—Presiding at the annual meeting, Mr. Sydney Straker said that the accounts dealt with a period of five months' trading, from July 29 last year, when the reorganisation of the capital was confirmed and the company re-took possession of their assets, to December 31. The balance sheet showed reductions in stock from £352,832 at March 1920, to £228,266, in the bank loan from £165,000 to £78,624, and in sundry creditors from £150,538 to £31,895, and the comparatively small loss of £15,812.

NORWICH ELECTRIC TRAMWAYS CO.—The annual report of this company for the year ended June 30, 1922, records total receipts of £86,147, an increase of £6,332, and total expenditure of £72,753, being a decrease of £3,127 on the previous year's working, leaving a net profit of £13,394, an increase over the previous year of £9,460, which is appropriated in the following way—£5,280 to payment of 2 per cent. dividend, subject to income-tax; £8,000 to reserve account; £114 to be carried forward. Car miles run aggregated 1,000,402; and passengers carried, 11,857,956. The earnings per car-mile were 20·67d., and the expenses per car-mile 16·82d., while the earnings per passenger were 1·72d.

HUDDERSFIELD CORPORATION TRAMWAYS.—Accounts for the year ended March 31, 1922, show tramway traffic receipts £265,872 and working expenses £214,138. After meeting capital and reserve and renewal charges, there is a deficiency carried forward of £11,980. Motor omnibus traffic revenue was £9,435, and working expenses were £8,210. The parcels carrying service brought in revenue amounting to £2,442, advertising on cars £608, and haulage of coal £521. The mileage of tramway cars was 2,650,337, and of coal trucks 2,840. Passengers numbered 33,421,878. The average number of cars in use daily was 87. The omnibuses numbered six, the average out per day being 3·24. Passengers carried totalled 749,511, the mileage being 101,644.

READING CORPORATION TRAMWAYS AND MOTORS.—The statement for the year ended March 31, 1922, shows that the traffic revenue of the tramways was £80,396, as compared with £85,119 for the previous year. Expenditure, mostly working expenses, £68,454, totalled £80,171, as against £101,184, giving a net surplus of £2,988, as against a previous deficiency of over £15,000, the present surplus being handed over to reserve fund. The traffic receipts from motor omnibuses were £17,398, as against £13,916, and the working expenses £15,373, as against £12,764, yielding a gross profit of £2,025, as against £892. The number of passengers carried by tramway car during the year was 11,349,857, over a million below the previous year's total. The car-miles run were 835,165, as against 914,379. The average number of cars in daily use out of 36 was 26, 20 of which were in use for 16 hours a day. The motor omnibuses ran 173,642 miles, and carried 1,353,626 passengers, both these figures showing an increase upon those of the previous year.

ILFORD URBAN COUNCIL TRAMWAYS.—The report for the year ended March 31, 1922, shows revenue £79,838, and expenditure £61,404, leaving a gross balance of £18,433, which, plus some additions and minus £11,245 in respect of sinking fund and mortgage debt charges, leaves a net profit of £8,152. There was a deficit last year of £499. The receipts were £9,788 more than those of the previous year, and the expenditure was £466 less. This profit is a record for the undertaking. The reserve fund now stands at £13,848, an increase during the year of £2,628, £3,673 having been paid out for track and overhead renewals, and £1,437 for car shed extensions. The capital expenditure is £183,562, an increase of £17,012 on that of last year, due to completion of payment for new cars. Details include the following—Miles run, 863,061, increase 68,432; passengers carried 11,299,254, increase 867,984; total receipts, £79,838 increase £9,788; receipts per car-mile 22·20d., increase 1·04d.; working expenses £61,405, decrease £467. The working expenses per car-mile have been reduced to 15·38d., a lower figure than that attained by any other unde taking in the country.

CAPE ELECTRIC TRAMWAYS.—The report for the year ended June 30, 1922, shows a profit of £80,703, and after providing for debenture interest and redemption, and including the balance brought from last year, there is a credit balance of £60,506. Of this sum £18,000 has been placed to the reserve fund, and the directors recommend a dividend of 6 per cent. free of income-tax on the ordinary shares, absorbing £29,473, leaving a balance of £13,032 to be carried forward. The gross receipts amounted to £414,570, and the passengers carried aggregated 31,283,916. The corresponding totals for the previous year were £397,124 and 29,773,587 passengers. The expenditure has been increased owing to arrears of maintenance, which were postponed owing to conditions due to the war. It is expected that the whole of these arrears will be made good during the next two years. The directors acknowledge the valuable services rendered by the local boards in Cape Town and Port Elizabeth, and by Mr. W. F. Long, the general manager at Cape Town, and Mr. W. H. Fremantle, the general manager at Port Elizabeth.

SOUTHPORT CORPORATION TRAMWAYS.—The report for the year ended March 31, 1922, shows that the gross revenue amounted to £78,943, and the working expenses to £51,242, leaving a gross profit of £27,701, which has been appropriated as follows—Interest on loans, £9,355; sinking fund contribution, £6,017; renewals fund, £6,628; income-tax, £3,800, deficit at March 31, 1921, £1,900. The receipts showed a decrease of £2,055 as compared with the previous year, caused chiefly by the reduction of the service of cars during the coal shortage in the summer. The receipts per car-mile averaged 23·321d., as compared with 23·184d. for the previous year. The total working expenses were 19·679d. per car mile, and revealed a saving of 9 per cent. as compared with the previous year, owing chiefly to the decrease in wages and cost of energy and reduction in car mileage. The gross profit of £27,701 is a record for the undertaking, being £3,012 higher than that of last year. The percentage of working expenses to receipts was 63·58, which compared with 69·52 in the previous year. The units per car-mile averaged 1·059, as compared with 1·115 in the previous year. The passengers numbered 9,266,712, or an average of 11·406 per car-mile. The department has 46 cars, and the route mileage is 23·250 miles.

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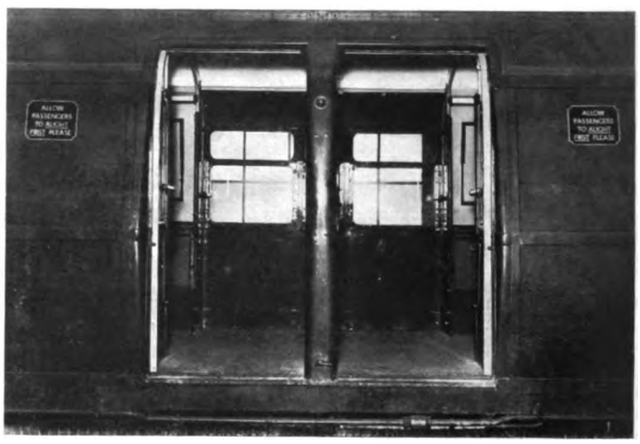
TRAMWAY COMMITTEES' CHAIRMEN.

Municipal Tramway Committees have now been appointed for the ensuing year, and we append a list of the chairmen and vice-chairmen. New appointments are indicated by an asterisk.

Town.	Chairmen.	Vice-Chairmen.
Aberdare	Coun. R. L. Berry ...	
Aberdeen	Coun. D. W. Beaton	
Accrington... ...	Ald. T. E. Higham ...	Coun. F. Lord
Ayr	Bailie J. Smith	Police Judge Murray
Bacup	Coun. J. Ireland ...	Ald. J. H. Lord
Barking	Coun. A. Whiting ...	
Barrow-in-Furness	Coun. R. Thompson ...	Coun. Warwick Bell
Belfast	Coun. W. G. Turner	Coun. D. Anderson
Bexley	Coun. A. J. Franklin	
Birkenhead ...	Coun. H. Halsall ...	*Ald. Vaughan
Birmingham ...	Ald. F. Smith	
Blackburn	Ald. C. Higham ...	Coun. G. Burke
Blackpool	Coun. H. Brooks (Mayor) ...	Coun. T. G. Lumb
Bolton	Coun. J. R. Horrocks	Ald. P. Higson
Bournemouth ...	*Coun. W. H. Ridout	*Coun. J. Frost
Bradford	Ald. E. Priestley ...	Coun. T. Taylor
Brighton	*Coun. H. M. Black ...	
Burnley	Coun. L. Thornber ...	*Coun. W. Buchanan
Burton-on-Trent	Ald. J. S. Rowland ...	Ald. T. E. Lowe
Bury	Ald. T. S. Collinge ...	Ald. H. Hargreaves
Chester	Coun. A. S. Dutton ...	Coun. A. Hart Davies
Chesterfield ...	Coun. P. M. Robinson	Ald. Sir E. Shentall
Colchester	Coun. G. F. Wright ...	*Coun. Wasey Chopping (Deputy Mayor)
Colne	*Coun. R. Knight ...	
Coventry	Coun. E. O. French ...	Coun. J. I. Bates
Croydon	Coun. A. A. Thomson	Ald. G. J. Allen
Darlington ...	Ald. Sir C. W. Starmer	
Darwen	Coun. G. Butterworth	Coun. G. Pickup
Derby	Coun. W. Eaton ...	
Doncaster	Ald. S. Balmforth ...	Coun. T. Bramworth
Dover	Coun. R. J. Barwick...	*Coun. D. H. Fox
Dundee	Coun. J. G. Fraser ...	
Eccles	Coun. W. T. Alexander	Ald. W. Pearson
Edinburgh ...	Coun. C. J. M. Mancor	Police Judge J. T. Goalen
Erith	*Coun. G. C. Humphreys	
Exeter	Coun. F. Chick	Coun. W. Brock
Farnworth ...	Coun. W. R. Winter	*Coun. J. Wilcockson
Glasgow	Coun. J. McWhirr ...	Bailie R. Laing
Gloucester	Coun. J. O. Roberts (Mayor) ...	*Coun. Gardner
Great Yarmouth	Ald. D. McCowan ...	Coun. R. Tunbridge
Halifax	Ald. T. Hey	Ald. H. H. Sutcliffe
Haslingden ...	*Ald. E. Russell ...	*Coun. T. Worsley
Heywood	Ald. J. Ashworth ...	Coun. J. R. Nuttall
Hull	Coun. A. D. Willougby	Coun. C. P. Sherwood
Ilford	Coun. G. R. Davey ...	Coun. A. Young
Keighley	Coun. J. Crabtree ...	
Kilmarnock ...	Coun. R. Dunlop ...	
Kirkcaldy	Coun. G. Fergusson ...	Provost Kilgour
Lancaster	Coun. I. J. Curwen ...	
Leeds	Ald. R. A. Smithson...	Ald. H. Brown
Leicester	Ald. G. Banton	Coun. W. K. Billings
Lincoln	Ald. W. S. White ...	
Liverpool	*Coun. T. White ...	Ald. Fred Smith
Lowestoft	Ald. F. Spashett ...	Coun. S. Walton
Lytham, St. Annes	*Coun. J. C. Martin ...	Coun. J. Chadwick
Maidstone	Ald. D. T. J. Lyle (Deputy Mayor) ...	Coun. T. Armstrong
Manchester ...	Ald. J. Bowes	Ald. A. W. Chapman
Middlesbrough ...	Coun. E. Turner ...	Ald. J. Calvert
Nelson	Ald. W. F. Cooke ...	
Newcastle	Ald. R. Mayne	*Coun. A. Oates
Newport	Ald. J. Moxon, O.B.E.	Ald. F. Phillips
Northampton ...	Ald. T. S. James ...	Coun. J. C. Wareing
Nottingham ...	Coun. J. Clarkson ...	Ald. A. Turney
Oldham	Coun. J. K. Cheetham	Coun. W. H. Sharpe
Perth	Coun. W. Munro ...	
Plymouth	*Coun. E. A. Earl ...	Coun. C. Harding
Pontypridd ...	*Coun. H. H. Evans ...	
Portsmouth ...	Coun. Sir J. Timpson, K.B.E.	Coun. E. H. Privett
Preston	Coun. J. Woolley ...	Ald. J. Ormrod
Radcliffe	Coun. J. H. Lund ...	
Rawtenstall ...	Coun. H. Crabtree ...	Ald. R. Ashworth
Reading	Ald. C. G. Field ...	
Rochdale	Ald. J. Taylor	
Rotherham ...	Ald. G. Gummer ...	Coun. S. J. Ellis
St. Helens	Coun. A. Rudd	Coun. J. Hewitt
Salford	Ald. W. H. Barrett (Mayor)	Coun. H. S. Hind
Sheffield	Ald. Sir W. E. Clegg...	Ald. W. C. Fenton (Lord Mayor)
Southampton ...	*Coun. P. V. Bowyer	
Southend	Coun. G. Radford ...	
Southport	Ald. T. S. Richardson	Coun. J. Lloyd
South Shields ...	Ald. J. G. Winskell ...	Coun. Stephenson
Stalybridge, Hyde, Mossley and Dukinfield ...	Ald. R. Wood	Ald. J. E. Rhodes
Stockport	Coun. T. W. Potts, O.B.E.	Coun. W. Merrison
Stockton and Thornaby	*Coun. R. M. Elliott ...	*Coun. R. Reed
Sunderland ...	Ald. G. New	Ald. W. Walker
Swindon	Ald. G. H. Stevens ...	*Coun. W. H. Bickham
Wallasey	*Coun. W. H. T. Brown	*Coun. S. P. Brick
Walthamstow ...	Coun. B. Clarkin ...	
Warrington ...	Ald. Sir P. Peacock ...	*Coun. G. Dale
West Bromwich	Ald. A. G. Turley ...	Coun. J. Wheatley
West Ham ...	Ald. J. T. Husband ...	
West Hartlepool	Coun. H. Salmon ...	Coun. G. W. Turnbull
Wigan...	Ald. R. T. Fletcher ...	Ald. J. Walkden
Wolverhampton	Ald. S. Craddock ...	Coun. A. Davies
York	Ald. C. W. Shipley ...	Coun. J. E. Gibbs

IMPROVEMENTS IN LODNON TUBE CARS.

Additional six-car trains of the latest type are now in service on the Piccadilly line of London Underground Railways. The principal feature of the new cars is an improved arrangement of doors. The old type Piccadilly car had but two doorways, one at each end. These end doorways are retained in the new cars, but there is also a 5 ft. 6 in. door in the centre. This overcomes one great difficulty, for whereas passengers were formerly reluctant to pass down the car if they were only travelling a short distance, they do not mind doing so in the new cars, as there is a way out in the centre. These centre doors are operated pneumatically, and not until the last of them is closed does the motorman receive the signal to start the



Centre Doors—5 ft. 6 in.—of Tube Train.

train. The signal is given automatically by an indicator electrically connected throughout the whole of the doors on each side of the train. The circuit in this indicator is broken unless each door is closed. Tests have been taken of the time of arrival and departure of these new trains at busy stations, and it is found that the stops have been reduced from 35 seconds to 25 seconds. Congestion on both trains and platforms is thereby considerably reduced. The new Underground rolling stock now being constructed will be provided with the same system of doorways as described above, and further improvements in connection with the seating, lighting, and decoration of the cars will also be incorporated with a view of making them as bright and comfortable as possible.

Paisley Tramways Sale.—At a meeting of the shareholders of the Paisley District Tramways Company, the sale of the company's undertaking to the Glasgow Corporation for £250,000 was approved, as were the proposals for the compensation of the directors and certain officials in respect of loss of office owing to the transaction.

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TRAMWAY AND LIGHT RAILWAY NOTES.

ABERDEEN.

NEW TRAMWAY OFFICES.

The formal opening of new offices for the Corporation tramway department in Union Bank Buildings recently was followed by a luncheon. The Lord Provost, proposing "The Corporation Tramways," expressed the opinion that the Corporation had a tramway service which could not be surpassed in any town in the country. Councillor D. W. Beaton, the convener of the Tramways Committee, responding, spoke of the expansion of the undertaking, which had necessitated the acquisition of new offices. Referring to the subject of electric cars as compared with motor omnibuses, he remarked that for extension into lightly-populated parts of the city the motor omnibus was very useful, but there was not yet any mode of street transit to beat the electric car. He still pinned his faith to the electric car for development.

BATH.

FARES TO BE REDUCED.

The Town Council have decided to support an application of the Bath Electric Tramways Company to the Ministry of Transport for a revision of the fares consequent upon the termination of the powers to charge the present rates on February 15, 1923. The Company submitted particulars of income and expenditure, together with proposals for reducing the present ordinary fares of 2d. and 2½d. to 1½d. and 2d. respectively.

BELFAST.

EXTENSION TO BE UNDERTAKEN.

After hearing a deputation representing shipworkers of the County Down side of the river, who urged reconsideration of the rejection of a proposal for a tramway line connecting the Queen's Road tramway by way of Hamilton Road and Dee Street Bridge with Connswater, the City Council decided by 20 votes to 16 that the extension, which it is estimated will cost £49,000, should be undertaken subject to the necessary power being obtained.

BIRMINGHAM.

DOUBLE-DECK RAILLESS CARS IN SERVICE.

The railless double-deck trolley car service from Old Square to Nechells was commenced on November 27, when the tramway cars were withdrawn from the route, with very satisfactory results. The cars, which were fully described and illustrated in our issue of November 16, have been supplied by Railless, Limited, and are equipped with two of the English Electric Company's 42 H.P. motors. As an informal inauguration of the new system, Alderman F. Smith, chairman of the Tramways Committee, and other members, Mr. A. Baker, general manager, Mr. A. C. Baker, chief engineer, and other officers travelled over the route in a special car, and subsequently received congratulations from the Lord Mayor, Alderman David Davis, on their enterprise in introducing the new system.

BURNLEY.

MERIT PAY.

The Tramways Committee have recently considered proposals of the employees' representatives in reference to compensation for the abolition of merit pay. It was suggested that one farthing per hour increase in basic rate be paid to all members of the running staff, and that merit pay at the rate of 13s. a quarter be granted, payment being made only if the employee's record for the quarter is satisfactory, regard being had particularly to his regular and punctual attendance for duty, his avoidance of accidents, and his economy in current consumption. Eventually the whole question as to whether the employees are entitled to the continuance of merit pay was referred to an arbitrator to be appointed by the Joint Council for the industry, payment for merit being continued in the meantime.

COLCHESTER.

ADVERTISEMENTS ON STANDARDS—GOGGLES FOR MOTORMEN.

The Tramways Committee have considered a resolution of the Colchester Chamber of Commerce Committee to the effect that the illuminated advertisements on the tramway standards do not add to the amenities of the town, and are unfair to traders and prohibitive in cost to small traders. A letter from a trader was also considered, complaining of the illuminated sign on a standard immediately in front of his premises. A sub-committee was appointed to make inquiries in regard to the matter.—The Town Council have agreed that they have no objection to the wearing of goggles by motormen who wish to do so.

DUNDEE.

WAGES REDUCTIONS.

The Wages and Conditions of Service Committee of the Town Council have decided by 5 votes to 3 to reduce the wages of tramway drivers by 4s., and of conductors by 2s. per week, placing them on an equal scale of 57s. to 60s. per week. Cleaners' wages are to be reduced by 2s., and those of inspectors, night foremen, and motormen by 4s. per week, while motor repairers are to have their wages fixed at 60s. per week. It was also agreed that in the event of a rise or fall of four points in the cost of living the wages were to be increased or reduced by 1s. per week, 70 per cent. above the pre-war cost of living to be the basic standard.

EDINBURGH.

THE CHANGE-OVER—PARKING CARS.

The Tramways Committee have expressed satisfaction with the way in which the change-over from cable to electric traction was made in Princes Street, where the new electric cars have been running over the permanent track for several weeks past. The further electrification of routes is awaiting the completion of the new power station at Portobello in a few months' time. It has been decided to purchase a piece of ground for a siding for parking tramway cars, with a view to dealing with the rush traffic caused by football matches. A proposal for season tickets between Edinburgh and Leith is being considered.

GLASGOW.

EXTENSIONS—THE SUBWAY—SIDE POLES—MEMORIAL

With a view to providing work for the unemployed several of the Corporation's tramway extensions are being put in hand, and it has been recommended by the Tramways Committee that others should be proceeded with. Plans and estimates for replacing the cable system in the subway by electricity are being prepared. Side poles are being put up to take the place of the centre poles in Great Western Road. A memorial arch has been erected at the head depot, inscribed with the names of 48 employees who gave their lives in the war.

HULL.

TRACK RENEWALS—AN EXPERIMENT—THE RAILS PROBLEM.

With a view to extensive tramway track renewals, the Town Council are applying to the Ministry of Transport for sanction for a loan of £100,000, which will, it is understood, be granted, provided that the amount of an unexpired loan on renewals shall be repaid out of the reserve fund. Assistance is being sought from the Unemployment Grants Committee to the extent of 50 per cent. of the loan. It has been decided, on the advice of the city engineer, Mr. F. W. Bricknell, to have the tramway track in Osborne Street laid on a ballast foundation, finished off with asphalt, instead of on a concrete foundation. This is being done as an experiment, which, if it meets with the success anticipated, will result in reduced cost and quieter running. With regard to tenders which had been received for 1,000 tons of rails, the Tramways Committee reported that the lowest tender was for German-made rails and recommended that a Sheffield firm, who submitted the next lowest tender, should be approached with a view to price reduction and the placing of the contract. The Council referred back the report for further consideration by the committee, who decided to invite the three British firms who had tendered to submit fresh tenders, with a view to accepting the lowest tender.

LEICESTER.

TRAMWAY EXTENSION.

The City Council have approved a scheme of tramway extension, the estimated cost of which is approximately £62,500, including £11,500 for the widening of a railway bridge and road work.

LONDON.

L.C.C. FARES—BEXLEY COUNCIL SECTION—CHILDREN'S FARES—"CITY" PROPOSAL—TRAILERS.

The London County Council has declined by 60 votes against 26 to make fare reduction on the tramways a matter of special reference to the Highways Committee, whose chairman, Mr. C. W. Matthews, said the question was always before them. The supporters of the reference pointed to the coming reduction of fares on the "Underground" railways and associated omnibuses as a reason why the fares on the Council's cars should also be reduced. In reply it was urged that the Council, while giving the matter every consideration, ought not to go back upon its policy of making the tramways self-supporting. The Council has decided not to exercise its rights of purchase of the small section, about a mile in length, of the Bexley Urban Council tramways, which is within the County of London, but to arrange for the continuance of through running between the systems. Reports have been asked from the Highways and Education Committees as to the advisability of issuing 2d.-all-the-way return tickets to school children and continuation scholars, to be available later than the present mid-day tickets and also on Saturdays. The City Corporation is being asked to consent to three short extensions into "the city," from the termini at Grays Inn Road, Farringdon Road, and Southwark Bridge. Trailers have been withdrawn for the present for experimental reasons from two of the Tooting services, and additional tractor cars have been put

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on instead. The withdrawal applies to the through services to Wimbledon, where the Borough Council have objected to the use of trailers on account of the narrowness of the streets. At a meeting of the Council in the first week of December certain fare revisions recommended by the Highways Committee were adopted. On and from January 1, 1923, the charges on workmen's tickets will be reduced by extending the distances for which present fares are chargeable; and in regard to ordinary fares, a further section will be added during the middle hours of the day, when the twopence all the way fare is available, to the stage of two sections for which a penny is usually charged.

MANCHESTER.

New Terminal in Cannon Street.

A new tramway terminal in Cannon Street, which will lessen the congestion in the centre of the city, is now in use. It is part of a scheme adopted by the City Council, under which it was decided to have terminals at Cannon Street, St. Peter's Square, Piccadilly, and Stevenson Square, where incoming cars could be turned round and sent back without passing across the traffic in Market Street, Cross Street, Mosley Street, and other centrally situated thoroughfares.

MIDDLESBROUGH.

Railless Traction Scheme.

The Ministry of Transport is being asked by the Tees-side Railless Traction Board for an order to authorise the use of railless trolley cars on a mile and a half of route in the neighbourhood of Middlesbrough, which will form an extension of the existing route from Grangetown to Eston.

NOTTINGHAM.

Proposed New Tramways.

The Corporation have decided to seek powers to construct several new tramways, chiefly for the purpose of linking up and thereby increasing the usefulness of their existing lines; and to raise fares and fix stages by the removal of the limitation by which not more than a penny may be charged for a distance not exceeding a quarter of a mile.

PERTH.

Lower Fares for Workmen.

On the Corporation Tramways on February 1, 1923, a concession will be made to workmen by the restoration of the old fare of a halfpenny per mile. The Tramways Committee recently received a letter from the Ministry of Transport drawing attention to the fact that the authority granted to the Corporation in 1921 to increase workmen's fares from a halfpenny to a penny per mile would expire in February, and stating that if the Committee desired a renewal of the order an application should be made at once. After consideration it was decided not to ask for renewal.

PRESTON.

Fare Reductions.

The Town Council have decided to restore the 1918 fare stages, to allow children to travel two stages for a halfpenny, and to issue packets of 18 tickets available for the short distance between Lancaster Road and the railway station for a shilling. It is hoped that the question of transfer tickets may be considered early next year.

SOUTHAMPTON.

Twenty-five Years with the Tramways.

The 25th year of the Corporation as tramway owners finds the borough tramway undertaking in a position of gratifying prosperity. For this, great credit must be assigned to Alderman F. A. Dunsford, J.P., whose resignation, after upwards of 24 years' service as chairman of the Tramways Committee, has recently been received. When the system was acquired by the Corporation in 1898 it was a comparatively small one, traversed by about 40 horse-drawn cars. At the present time the service, of which Mr. J. Dobson is manager, can compare favourably with any in the country. The capital expenditure has totalled £379,920, a total loan debt of £359,699 has been incurred, and £172,342 of that amount has actually been repaid. The sum of £20,221, which in ordinary circumstances might have been capital expenditure, has been defrayed out of profits, and the total of £64,577 has been contributed by the undertaking to the relief of the rates.

SOUTHEND-ON-SEA.

Reduced Fares.

The Town Council have adopted a report of the Light Railways Committee, in which it was stated that after careful consideration of the financial estimates of the undertaking for the year ending March 31, 1923, which provide for a reduction from 3¼d. to 2½d. per unit in the cost of current used upon the light railways, it was felt that the fares in operation prior to the increase in June, 1921, should be reverted to. The adoption of the report involves a return to penny fares. The reduction took effect on December 1.

SOUTHPORT.

Discount Tickets Reduced.

The Tramways Committee have decided that the only concession they can recommend in the direction of reducing fares is that books containing fourteen 2d. tickets shall be 1s. 9d. instead of 2s. A proposal to create shorter stages at smaller fares is regarded as inadvisable, in view of the large proportion of the revenue which is derived from visitors.

STALYBRIDGE.

Prospects in the District.

Alderman H. Sykes, of Mossley, the newly-elected chairman of the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board, has expressed the opinion that the Board will be able to dispense with the financial help from the four authorities which has been necessary in the past. He has also announced that the Board intends to apply for permission to extend the time for the construction of the tramways that will link up their system with that of Glossop, and that they will seek powers to run omnibuses in several districts not served by the tramways.

SUNDERLAND.

Wages Reduction.

The Town Council have decided to reduce the tramway employees' wages all round by 4s. a week. It was explained that this reduction, which was a compromise, was necessary to put the tramways on a commercial basis. Twenty-one men had been discharged and the service had been reduced to a minimum, but, notwithstanding that, there was at present a loss of 2½d. per car-mile, which would equal £16,000 a year. It is understood that the employees accept a reduction of 2s. in December and 2s. in January, and that there will be a complete revision of wages in March.

WALTHAMSTOW.

Employees' War Memorial.

A memorial to the employees of the tramway department who gave their lives in the war has been placed in the Tramway Depot Recreation Hall. It is a tablet consisting of a teak framework with a mahogany centre panel, upon which are inscribed in gold letters the names of the fallen, and is the work of their comrades in the department. When the tablet was unveiled by Councillor D. J. Quinn, J.P., chairman of the Urban Council, and dedicated by the Bishop of Barking, there were present, in addition to a representative body of the tramway employees, many members of the Council and their ladies, and many of the officials, including the tramways manager, Mr. W. Murray, who assisted at the ceremony.

WEST BROMWICH.

Town Council and the Tramways.

The future of the tramways in West Bromwich will shortly have to receive consideration from the Town Council. The tramways were purchased by the Corporation under its Act of 1900, and subsequently the lines were reconstructed, equipped for electric traction, and leased to the South Staffordshire Tramways Company, and the Birmingham District Power and Traction Company, for a term of 21 years.

YORK.

New Staff Conditions.

The Tramways Committee intend to give a month's notice to their employees to terminate existing arrangements as to wages and conditions, and to reorganise the staff on a basis providing for correct union rates being paid. The new plan, it is estimated, will effect a saving of £1,755 per annum.

"Underground" Efficiency Meeting.—Mr. H. E. Blain, C.B.E., presided at an "Underground" Efficiency Meeting held at the Training School of the London General Omnibus Company recently. The interest of the subject for discussion probably accounted for the record attendance of 387, the topic being "Progress in 1922." Mr. J. Hodge, chief inspector of the L.E.R., C.L.R. and C. & S.L.R., reviewed the various improvements introduced upon the railways during 1922. Mr. Owen Watson, research engineer to the London General Omnibus Company, dealt with the many experiments made from time to time in laboratories at Chiswick, having as their aim the evolution of an omnibus perfect in every detail. Mr. L. B. Newitt, technical assistant to the tramways section, reviewed the improvements effected on the tramways, particularly as regards the quick repairing and relaying of lines. All three papers were amply illustrated by lantern slides and films. It is customary to follow the reading of the papers with a debate; but owing to the huge field covered by the three lecturers this discussion was necessarily curtailed. The meeting terminated with speeches by the chairman and Mr. C. J. Spencer, general manager of the tramways, the keynote of both speeches being an appreciation of the spirit of co-operation which exists between the railway, omnibus and tramway sections of the company, without which the progress and improvements made would have been impossible.

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PERSONAL.

Councillor H. Brooks, who has been chairman of the Tramways Committee, is the new mayor of Blackpool.

Alderman W. H. Barrett, who has been chairman of the Tramways Committee, has been elected Mayor of Salford.

Councillor F. C. Wilson, who has been chairman of the Tramways Committee, is the new Lord Mayor of Liverpool.

Alderman J. B. Burman, J.P., has been again appointed chairman of the Birmingham Electric Supply Committee.

Mr. E. Shrapnell-Smith has been appointed a director of the Aldershot and District Traction Company, Limited.

Alderman W. C. Fenton, who has been vice-chairman of the Tramways Committee, has been elected Lord Mayor of Sheffield.

Mr. W. N. Bancroft, secretary of the Midland Railway Company, has been appointed president of the Chartered Institute of Secretaries.

Councillor J. O. Roberts, who has been chairman of the Electricity and Light Railways Committee, has been re-elected Mayor of Gloucester.

Alderman William Bramble, a member of the Newcastle-upon-Tyne Transport and Electricity Committee, has been elected Lord Mayor of Newcastle.

Mr. George D. Killey, J.P., has been appointed chairman of the Liverpool Overhead Railway Company in place of the late Mr. Harvey C. Woodward, J.P.

Bailie John McWhirr has been reappointed convener of the Glasgow Corporation Tramways Committee, and **Bailie Robert Laing** has been reappointed sub-convener.

Mr. W. Murray Wilson has been appointed chairman of the La Plata Electric Tramways Company, and **Mr. John Adams** and **Major G. O. S. Pringle** directors of the company.

Councillor P. V. Bowyer has been appointed chairman of the Southampton Tramways Committee, in succession to Alderman F. A. Dunsford, J.P., who has retired after serving in that capacity for 24 years.

Mr. R. R. Fairbairn, who has been elected Member of Parliament for Worcester, was formerly manager of the Worcester Tramways Company. During the war he was Director of Food Transport for the Midlands.

Mr. Neville Chamberlain, M.P., has resigned his seat on the boards of the Daimler Company, the Birmingham Small Arms Company and Elliott's Metal Company on accepting the appointment of Postmaster-General.

Mr. G. H. Hume, who has been elected Member of Parliament for Greenwich, was formerly chairman of the Highways Committee of the London County Council, of which he has long been an active and influential member.

Mr. F. A. Parnwell, assistant general manager of the Great Eastern Railway, has been appointed general manager in succession to Sir Henry Thornton, who has left London to take up the general management of the Canadian National Railway.

Alderman R. A. Smithson, who has been re-elected chairman of the Leeds Tramways Committee, has held that position with conspicuous success continuously since 1898 with the exception of four years, during which he was chairman of other committees of the Council.

Sir Philip Nash has been appointed chairman of the Metropolitan-Vickers Electrical Co. Ltd., in place of Mr. J. Annan Bryce, who is retiring for health reasons, after many years in the chair of the company, and its predecessor, the British Westinghouse Co. Ltd. Sir Philip Nash was formerly head of the Great Northern Railway locomotive department, and from 1899 to 1915 chief in the same department of the East Indian Railway. He rendered valuable service during the war as Director of National Filling Factories under the Ministry of Munitions, and in 1916 became Deputy Director-General and later Director-General of Transport in France. It is understood that he will take an active part in the control and direction of the great undertaking at Trafford Park, over whose activities he will henceforth preside. The Metro-Vickers works, when fully engaged on production, find employment for seven thousand persons.

The late **Mr. L. G. Robinson,** a director of the Underground Electric Railways Company, and a member of the Stock Exchange, left £236,000, net £133,900.

The late **Mr. Charles Aldington,** general manager of the Great Western Railway, and formerly traffic superintendent of the Central London Railway, left £3,493.

We regret to record the death, as a result of being knocked down by a motor car, of **Mr. J. B. Humphreys,** director and manager of Ferguson Superheaters, Limited, of 20 Kingsway, W.C. At the inquest the coroner made some strong remarks in regard to the danger of dazzling headlights, which were the cause of this fatality.

CONTRACTS AND ORDERS.

Poplar Electricity Committee have ordered a boiler costing £14,000 from the Spearing Boiler Company, Limited.

Maidstone Town Council have placed an order with the Union Cable Company, Limited, for feeder cable at £544.

Watford Corporation have ordered two water tube boilers of 30,000 lb. from the Spearing Boiler Company, Limited.

Brighton Tramways Committee have placed an order with Yarrow and Company, Limited, for boilers at the Southwick power station extension.

Poplar Electricity Committee have accepted a tender for e.h.t. switch gear at £4,362 from the Metropolitan-Vickers Electrical Company, Limited.

Wolverhampton Corporation have authorised the purchase of an electric welding plant from the Equipment and Engineering Company for £200.

Blackpool Tramways Committee have accepted the tender of Brown Bayley's Steel Works, Limited, for the supply of 50 driving tyres and 30 pony tyres.

Grimsby Corporation have accepted the following tenders—General Electric Co. Ltd., traction feeder switchgear, £434; and Ferguson, Pailin, Ltd., switchgear, £216.

West Hartlepool Corporation have ordered from Railless, Limited, of London, four railless trolley cars, fitted with single-deck bodies, seating 36 passengers, for £1,612 10s. each.

Metropolitan Railway Extension.—It is reported that the contract for the extension of the Metropolitan Railway to Watford has been placed with Logan and Hemming, of Doncaster.

Preston Corporation Tramways Committee have recommended acceptance of the following tenders—Hadfields, Ltd., crossings, points, etc., £444 5s.; Walter Scott, Ltd., 16 tons of rails, £11 5s. and £11 per ton.

Bradford Tramways Committee have recommended the acceptance of tenders of British Insulated and Helsby Cables, Limited, for 1,000 copper rail bonds, at 2s. 5d. each, and Hadfields, Limited, for 4 tons tie bars, at £15 7s. 6d. per ton.

Sheffield Tramways Committee have recommended the tender of Stewarts and Lloyds, Limited, of Glasgow, for the manufacture, supply and delivery of 100 steel tramway poles, complete with protective sleeves, at the rate of £9 2s. 9d. per pole.

Bournemouth Town Council have accepted a tender (one of seven) for materials for the reconstruction of the tramway lines on the portions now remaining to be done, from Dorman, Long and Company Limited, at £4,725 for rails, and £68 for fish plates.

London County Council have accepted the tender of Dallow, Lambert and Company, for the installation of heating and ventilating apparatus at the central repair depot at £4,367. Eleven tenders were received, ranging from £4,367 to £8,550. The architects' estimate comparable with the tenders was £5,324.

South Eastern Railway Electrification.—A contract has been arranged with the London Electric Supply Corporation for the supply of electric energy required by the South Eastern Railway Company for the electric working of their suburban lines. The Deptford station has supplied electric energy to the London, Brighton and South Coast Railway Company since their suburban lines were first electrified.

Kirkcaldy Corporation have awarded to Buckley, Saunders and Company, Limited, a second contract at £650 for welding. At a recent meeting of the Town Council, Mr. O. F. Francis, manager and electrical engineer, said that the firm expected to complete their welding contract on the upper route track shortly. In his opinion the work had been done so satisfactorily and expeditiously that he advised that they be asked to weld the single track from West End Links to Junction Road.

South African Railways.—Contracts have been placed for the electrification of the Glencoe-Pietermaritzburg section of the Natal Railway. The contracts involve an expenditure of nearly £4,500,000 and have been secured by the Metropolitan-Vickers Electrical Co. Ltd. (nearly £1,000,000), C. A. Parsons and Co. Ltd., Babcock and Wilcox, Ltd., the British Thomson-Houston Co. Ltd. (£400,000), the Telegraph Manufacturing Company, A. Reyrolle and Co. Ltd., and the South African General Electric Company. Siemens Brothers and Co. Ltd., have been awarded a contract at £100,000 for automatic telephone exchange equipment. These contracts were secured, it is understood, in the face of keen American and German competition. The Metropolitan-Vickers Company are to build 78 electric locomotives. Some time ago this company secured a large contract for electrical equipment in connection with the South African railway electrification scheme.

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Contract for Edinburgh Cars.—Edinburgh Town Council have accepted the tender of the Leeds Forge Company for 56 top-covered car bodies at £40,600, or £725 per car. At the meeting on November 23, when the Tramways Committee's recommendation was adopted, a long discussion took place. Mr. George Stark asked if, with a view to relieving local unemployment, a part of the contract should not be given to a local firm who had tendered. Mr. C. J. M. Mancor, convener of the Tramways Committee, said that the committee naturally looked with sympathetic eyes on local tenders, but the difference in the amounts was beyond the possibilities of consideration. The offer by the local firm amounted to £49,280, a difference of £8,680. The price per car would be £880, as against £725 in the tender recommended, a difference per car of £155. Having advertised for tenders, and satisfied themselves that the Leeds Forge Company could do the work, the committee had no alternative but to accept the tender. Mr. Stark moved an amendment that 20 of the cars be ordered from the local firm at the price of the lowest estimate. In answer to a question, Mr. Mancor stated that the car bodies would be built by the Bristol Carriage and Wagon Company. The Leeds Forge Company had amalgamated with the Bristol and another company, the Forge Company retaining a controlling interest. Mr. Mancor said that they had to carry on the tramways in such a way as to give cheap transport, and to do this they must buy in the best market. Any man who went back to his constituents and told them he had accepted an estimate £8,000 higher than another offer would not remain long in the Council. They were there as trustees of the public, and they ought to do as they would do in their own business. They had offers from other companies to build the cars, varying from £777 to £880 or £1,045. He held that they were in duty bound to accept the lowest offer in this instance. The recommendation of the committee that the order should be placed with the Leeds Forge Company was finally accepted by 41 votes to 18.

PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given in italics.

Applications for Letters Patent.

The number of the patent is given in brackets.

Bodies of motor vehicles (30,158)—Auto-Carriers, Limited, and S. Smith.
Rail joints (29,870)—A. G. Conway and Woods-Gilbert Rail Remodelling Company, Limited.
Lifting jacks (30,061)—Eagle Engineering Company, Limited, and R. G. Palmer.
Lifting jacks (29,830 and 29,831)—C. F. L. King and A. I. B. Maxfield.
Means for deadening noise of tramcars (30,085)—A. Loré.
Spring suspension of motor vehicles (30,176)—G. F. Melen and H. C. Melen.
Steering mechanism of motor vehicles (30,177)—G. F. Melen and H. C. Melen.
Motor vehicles (29,730)—O. D. North.
Lubrication of gear boxes (29,731)—O. D. North.
Bodies of motor vehicles (29,887)—G. Salmons and W. J. P. Sully.
Bodies for motor vehicles (29,589)—Vulcan Motor and Engineering Company (1906), Limited, and C. B. Wardman.
Brake gear for railway, etc., vehicles (30,379)—A. S. Bailey and Cammell Laird and Company, Limited.
Roofs for railway, etc., vehicles (30,380)—A. S. Bailey and Cammell Laird and Company, Limited.
Means for operating points and/or cable switches of tramways, etc. (30,571)—G. Bromilow.
Variable speed gear for motor vehicles (30,274)—G. H. Ephgrave.
Lifting jacks (30,695)—S. J. Jenkins.
Controls of motor vehicles (30,801)—A. E. Sentinella.
Stabilising devices for motor vehicles (30,315)—Soc. Anon. La Suspension J. Poyet.
Suspension of front axles of motor vehicles (30,316)—Soc. Anon. La Suspension J. Poyet.
Mechanically propelled vehicles (30,364)—W. L. Spence.
Transport vehicles (31,265)—S. E. Alley.
Self-actuated means for adjusting brakes of motor vehicles (30,998)—T. Balshaw.
Universal joint for mechanically propelled vehicles (30,954)—L. Bloom.
Ventilators for railway vehicles, etc. (31,346)—Cammell Laird and Company, Limited, and A. S. Bailey.
Brakes for motor vehicles, etc. (30,955)—J. Duffy.
Electric traction (31,114)—G. H. Fletcher and Metropolitan-Vickers Electrical Company, Limited.
Driving and power transmission in motor vehicles (31,498)—Lancia and Company.
Combined lifting jack and trolley (30,946)—D. Mitchell, J. Mitchell, J. I. Mitchell and R. Mitchell.

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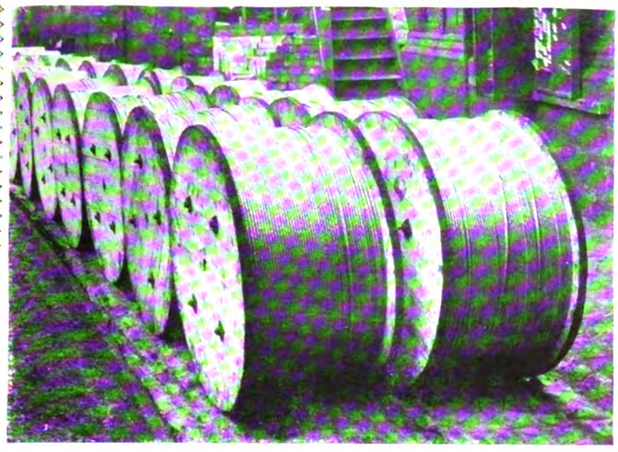

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Universal joints (31,115)—W. J. Palmer.
Sanding devices for electrically propelled vehicles (31,286)—P. Priestly.
Motor vehicles (31,202)—N. Rycroft.
Route indicators, etc. (31,514)—E. Shrubsole.
Control gear for motor vehicles (32,215)—Argson Engineering Company, Limited, and L. Murphy.
Transport vehicles (32,177)—Associated Equipment Company Limited, and C. K. Edwards.
Automatic control of electric motors (31,984)—L. Backhouse and the Electro-Mechanical Brake Company, Limited.
Traction systems employing a centre gripping rail (31,967)—G. N. Fell.
Motor vehicles for roads and rails (32,224)—A. Galbraith, Roadrails, Limited, and R. S. Stronach.
Trailer vehicles (32,193)—R. Garrett and Sons, Limited, and M. L. Luiggi.
Road vehicles (32,195)—R. Garrett and Sons, Limited, and M. L. Luiggi.
Power transmission mechanism for motor vehicles (31,824)—E. H. J. C. Gillett.
Lifting jacks (31,889)—A. E. Lake.
Brake mechanism for vehicles (32,074)—A. Toms (*J. G. Brill Co.*).
Electric tramways and railways (31,827)—G. R. P. Wheatley.

SPECIFICATIONS PUBLISHED

1921

Electric power transmission and braking systems (11,966—*186,953*)—British Thomson-Houston Company, Limited (*General Electric Company*).
Motor vehicles (18,211—*186,980*)—A. Morgan.
Motor vehicles (18,886—*180,620*)—L. Renault.
Master controllers for electrical control systems (19,351—*187,038*)—N. E. North and Metropolitan-Vickers Electrical Company, Limited.
Speed regulating devices for electrically driven vehicles (20,595—*187,059*)—D. E. Batty and Associated Equipment Company, Limited.
Systems of electric motor control and apparatus therefor (25,148—*187,117*)—British Thomson-Houston Company, Limited (*General Electric Company*).
Brakes for motor vehicles (20,508—*187,354*)—W. T. Groom.
Power transmission mechanisms of electrically driven vehicles (20,850—*187,360*)—W. E. Moore.
Current transmission devices for ball bearings in electrically driven rail vehicles (26,887—*171,366*)—J. Schmid-Roost, Limited, Ball Bearing Works.
Coupling for use with tramway cars (29,394—*187,471*)—J. Williams.
Electrically driven vehicles (29,446—*172,288*)—G. Meyfarth and Soc. Anon. des Ateliers de Secheron.
Chair for securing rails to unperforated metal sleepers (29,604—*187,473*)—J. Pira.
Springing, engine-mounting, and transmission of motor vehicles (30,169—*187,477*)—W. Laffan and C. Clarke.
Brakes for motor vehicles (34,840—*187,520*)—E. T. Jackson.
Seats for motor vehicles (21,406—187,750)—M. Woods.
Pneumatic brakes (11,880—*188,002*)—I. Drolshammer.
Electric braking motor vehicles (17,621—*188,021*)—P. F. Smith and P. V. Powell.
Braking apparatus for vehicles (20,338—*188,052*)—A. V. Tomlinson (*Westinghouse Air Brake Company*).
Chassis of motor vehicles (21,821—*168,312*)—J. S. De Miranda and M. Varallo.
Differential gear for motor vehicles (27,079—*188,171*)—M. Fischer.

1922.

Power plants for use on motor vehicles (1,645—*187,171*)—Vulcan Motor and Engineering Company (1906), Limited, and E. G. Grinham.
Power-driven vehicles (17,711—*182,470*, 17,714—*182,473*, and 17,941—*182,483*)—Atlantic Akt.-Ges. fur Automobilau.
Track appliances for handling rails, etc. (412—*187,896*)—N. M. Clougher.
Double pole for the supporting of electric power wires (6,008—*187,909*)—J. E. Rutter.
Trucks for tramway vehicles (16,733—*187,927*)—S. Thomas and The Peckham Truck and Engineering Company, Limited.

BUSINESS NOTICE.

G. D. PETERS AND COMPANY.—The London office of this company has been transferred to more convenient offices at Caxton House, Tothill Street, Westminster, S.W.1. The Consolidated Brake and Engineering Co. Ltd., of 15 Dean's Yard, Westminster, and the British Air Brake Co. Ltd., of 64 Victoria Street, companies of which G. D. Peters and Co. Ltd. are the sole proprietors, are also transferring their offices to the same address. Telephone, Victoria 2900; telegrams, Peters Vic, London; cables, Peters London. Messrs. G. D. Peters and Co. Ltd. inform us that Mr. J. W. Cross, who is director of the British Air Brake Company, Limited, has now, in addition, been appointed manager of their railway department. Mr. Cross, who has an extensive railway connection, is enabled to hold these dual offices, as Messrs. G. D. Peters & Co. Ltd. have become proprietors of the British Air Brake Company, Limited.

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1921. WEEKS ENDED					1922. WEEKS ENDED					AGGREGATE.		
	Nov. 5	Nov. 12	Nov. 19	Nov. 26	Dec. 3	Nov. 4	Nov. 11	Nov. 18	Nov. 25	Dec. 2	Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	3,435	3,355	3,323	3,190	3,405	3,231	3,326	3,350	3,172	3,166	26¾	96,338	– 205
Aberdeen Motor Buses	122	120	119	115	125	152	225	154	150	140	26¾	7,239	– 325
Ashton-under-Lyne	...	1,537	1,429	1,414	1,408	...	1,350	1,349	1,321	1,326	35	51,200	+ 4,323
Ayr Corporation	502	474	469	472	469	493	500	498	478	491	29	22,978	– 778
Barrow Corporation	846	725	727	724	718	483	521	504	484	498	35	21,048	– 9,681
Belfast City Tramways	12,529	12,019	12,248	11,715	11,683	12,076	12,359	12,434	12,236	12,308	35	421,631	– 19,530
Birkenhead Corporation	2,698	2,473	2,466	2,506	2,540	2,222	2,269	2,233	2,158	2,215	35¾	84,768	– 7,573
Birkenhead Motor 'Buses	517	507	492	495	488	608	632	634	611	603	35¾	27,255	+ 2,253
Birmingham Corporation	29,314	28,546	28,716	28,613	29,358	25,186	25,569	25,218	25,396	25,889	35	967,792	– 65,111
Birmingham Motor 'Buses	1,781	1,691	1,678	1,664	1,728	1,606	1,651	1,591	1,645	1,701	35	63,885	– 8,364
Blackburn Corporation	2,649	2,301	2,278	2,314	2,175	2,250	2,158	2,309	2,180	2,155	35¼	86,973	+ 1,445
Bradford Corporation	14,000	13,448	13,105	13,187	13,337	12,218	11,729	11,940	11,631	11,616	36	487,868	+ 3,455
Brighton Corporation	2,002	1,793	1,809	1,830	1,707	1,860	1,964	1,840	1,795	1,790	35¾	88,877	+ 1,755
Burnley Corporation	3,576	3,248	3,182	3,252	3,189	3,109	3,113	3,102	3,006	3,020	—	—	—
Burton-on-Trent Corporation ...	597	549	561	560	554	560	557	516	503	530	34	19,875	– 2,315
Bury Corporation	2,388	2,195	2,258	2,290	2,240	2,260	2,340	2,399	2,230	2,296	36¾	87,984	+ 189
Camborne and Redruth	...	...	192	182	199	...	...	204	182	186	48	9,207	– 1,181
Chatham and District	1,601	1,484	1,435	1,497	1,192	1,362	1,491	1,402	1,469	1,410	48	78,856	– 1,157
Chesterfield Corporation	1,409	1,392	1,347	1,319	1,259	1,222	1,221	1,260	1,197	1,177	34	42,976	– 4,933
Darlington Corporation	...	...	533	546	544	...	...	477	459	457	35¼	17,865	– 2,422
Derby Corporation	2,151	1,941	2,187	1,990	1,977	2,002	2,101	2,180	1,998	2,031	35	76,272	– 282
Dundee City	3,134	3,095	3,041	3,010	3,015	2,853	2,906	2,942	2,871	2,774	28¾	85,772	– 7,263
East Ham Corporation	2,198	2,063	1,993	2,079	1,972	2,041	2,115	1,959	1,904	1,986	35¼	74,032	– 381
Edinburgh Corporation	15,556	14,531	14,978	15,009	...	14,713	14,807	14,963	14,442	...	28	444,192	– 27,045
Glasgow Corporation	46,503	44,675	45,126	44,931	44,634	42,608	42,855	43,509	42,727	43,239	26¼	1,127,200	– 79,740
Glossop (Urban Elec. Supply Co.)...	248	227	232	243	231	225	214	214	208	201	48	10,784	– 539
Halifax Corporation	4,410	4,165	4,034	3,996	4,061	4,101	4,058	4,105	4,058	3,896	34¼	152,042	– 1,767
Halifax Motor 'Buses	66	58	58	59	62	89	63	83	78	74	34¼	2,967	+ 135
Halifax Railless Cars	49	55	49	49	38	25	49	26	27	27	34¼	1,446	+ 332
Huddersfield Corporation	5,124	4,767	4,803	4,828	4,822	5,259	5,303	5,360	5,168	5,220	36	195,722	+ 914
Hull Corporation	...	6,708	6,781	6,778	6,804	...	6,396	6,366	6,192	6,288	35¼	232,628	– 13,781
Ilford U.D. Council	1,475	1,364	1,346	1,335	1,349	1,425	1,457	1,345	1,362	1,410	35¼	51,186	– 2,059
Ipswich Corporation	831	744	730	737	709	706	756	716	697	695	35	29,784	– 1,348
Isle of Thanet...	716	586	535	520	495	553	602	564	521	485	8¾	5,432	– 940
Kilmarnock Corporation	361	327	336	324	331	301	316	306	297	304	28¾	9,359	– 1,228
Leicester Corporation	7,404	6,642	7,167	6,957	6,983	7,194	7,400	7,241	7,052	7,023	48	352,179	+ 37,275
Liverpool Corporation	30,343	29,172	28,740	29,012	29,393	27,043	28,167	27,499	27,272	27,822	48	1,402,812	+ 7,354
London County Council	101,768	99,107	95,910	97,755	91,712	92,388	93,845	91,525	90,156	90,300	34¼	3,240,532	– 280,048
Maidstone Corporation	440	409	389	394	344	382	407	404	392	379	34¼	17,090	– 103
Manchester Corporation	38,283	36,488	36,729	37,135	...	34,489	35,063	34,759	34,962	...	34	1,213,949	– 124,250
Newcastle-on-Tyne Corporation ...	11,339	10,775	10,581	10,738	11,046	9,993	9,834	9,799	9,771	9,816	35	358,677	– 40,827
Nottingham Corporation	7,598	7,367	7,127	7,266	7,117	7,489	7,644	7,445	7,422	7,386	35	272,054	+ 37,955
Oldham Corporation	4,695	4,544	4,600	4,611	4,479	4,303	4,451	4,397	4,242	4,395	36	166,646	– 9,469
Portsmouth Corporation	4,647	4,165	4,041	4,079	4,118	3,850	4,106	4,009	3,768	3,924	35	177,286	– 14,286
Preston Corporation...	1,884	1,896	1,827	1,778	1,772	1,673	1,773	1,737	1,651	1,598	34½	66,583	– 552
Preston Motor 'Buses	...	...	...	...	...	138	146	147	130	135	34½	4,826	—
Reading Corporation	1,581	1,505	1,435	1,458	1,411	1,408	1,423	1,532	1,356	1,382	35	53,733	– 2,012
Reading Motor 'Buses	312	299	268	265	235	332	333	333	311	307	35	12,693	+ 499
Rochdale Corporation	...	...	3,062	3,134	3,075	...	...	3,044	2,946	3,084	35¼	114,220	—
Rotherham Corporation	2,373	2,460	2,180	2,155	2,151	2,067	2,200	2,110	2,029	2,062	34	72,066	– 4,906
St. Helens Corporation	1,498	1,638	1,519	1,566	1,561	1,427	1,498	1,485	1,435	1,419	35	54,988	– 8,363
Salford Corporation	10,418	9,955	10,186	11,275	10,298	9,456	9,774	9,718	10,648	9,694	35¾	355,698	– 25,465
Sheffield Corporation...	19,496	18,671	18,468	18,603	18,605	17,810	18,213	17,744	17,586	18,148	35¾	640,397	– 52,462
Southampton Corporation	3,018	2,862	2,790	2,872	2,849	2,862	2,973	2,929	2,810	2,755	35	110,187	+ 5,900
Southampton Motor 'Buses	101	100	95	93	97	188	200	192	179	175	35	4,552	– 1,367
Southend Corporation	2,096	1,893	1,856	1,808	1,771	1,949	1,974	1,995	1,850	1,891	36	98,761	+ 3,243
South Shields Corporation	1,742	1,623	1,648	1,653	1,648	1,547	1,590	1,577	1,515	1,526	35	58,570	– 1,020
Sunderland Corporation	2,588	2,417	2,430	2,471	2,396	2,242	2,346	2,244	2,156	2,266	35	88,674	– 5,091
Swindon Corporation	369	380	337	340	331	294	310	325	315	293	34½	12,386	– 1,764
Tyneside Tramways and Tramroads	1,026	930	895	889	894	767	768	775	747	734	22	18,800	– 5,717
Wallasey Corporation	2,774	2,515	2,533	2,563	2,537	2,385	2,395	2,362	2,332	2,320	35¼	92,904	– 7,476
Wallasey Motor 'Buses	214	160	193	174	196	234	186	242	193	235	35¼	8,794	+ 105
Walsall Corporation	1,620	1,492	1,507	1,504	1,541	1,403	1,461	1,420	1,391	1,412	35	52,734	– 5,518
Walsall Motor 'Buses	901	811	817	829	873	703	751	660	680	700	35	27,855	– 5,375
Walthamstow U.D. Council	1,933	1,702	1,676	1,630	1,563	1,678	1,679	1,603	1,670	1,646	35¼	66,377	– 8,371
Warrington Corporation	1,170	976	965	980	969	972	978	993	935	959	35	33,738	– 799
West Ham Corporation	6,126	5,926	5,723	6,072	5,321	5,487	5,551	5,178	5,317	5,259	34½	197,623	– 9,992
Wolverhampton Corporation ...	2,355	2,285	2,174	2,225	2,138	1,931	1,990	2,017	1,885	1,888	35	72,989	– 9,121
Wolverhampton Motor 'Buses ...	639	628	605	628	599	589	609	583	564	558	35	22,257	– 555

Underground Electric Railways Company of London, Limited.

NAME OF COMPANY.	1921. WEEKS ENDED					1922. WEEKS ENDED					AGGREGATE.		
	Nov. 5	Nov. 12	Nov. 19	Nov. 26	Dec. 3	Nov. 4	Nov. 11	Nov. 18	Nov. 25	Dec. 2	Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Underground Rlys. & L.G.O. Co. ..	229,124	224,194	217,029	216,130	205,388	224,320	234,454	217,065	224,850	226,418	48	10,927,160	– 398,820
London and Suburban Traction .	50,976	47,386	46,937	46,109	42,984	41,300	41,692	38,794	40,104	40,505	48	2,274,944	– 345,764

Colonial and Foreign Tramway Traffic Returns.

NAME OF COMPANY.	1921. WEEKS ENDED					1922. WEEKS ENDED					AGGREGATE.		
	Nov. 5	Nov. 12	Nov. 19	Nov. 26	Dec. 3	Nov. 4	Nov. 11	Nov. 18	Nov. 25	Dec. 2	Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	86,049	84,353	84,269	83,777	81,991	92,889	90,597	92,739	91,117	90,572	48	4,084,580	+ 232,652
Calcutta ... ... Rs.	5,741	10,271	11,956	60,346	93,498	114,994	12[illegible],380	118,998	121,819	123,562	48	5,185,703	+ 1640,211
Madras... ... ... Rs.	...	(2 weeks)	46,251	(2 weeks)	43,605	...	(2 weeks)	40,891	(2 weeks)	40,985	47	1,055,972	+ 140,102
Pernambuco ... ... $	4,164	3,773	3,681	3,778	3,939	3,885	4,090	4,314	4,306	4,050	48¼	177,978	– 9,184

	1921.						1922.						Wks.	AGGREGATE.	
	June	July	Aug.	Sept.	Oct.	Nov.	June	July	Aug	Sept.	Oct.	Nov.		1922.	+ or –
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo	4,135	3,842	3,810	4,231	4,682	...	4,212	3,770	3,990	4,414	4,789	...	28	29,977	– 414
Brazilian Trac. Mlrs	14257000	15477000	15744000	14471000	1501600	...	16266000	16655000	17168000	17572000	1823100	...	43	162141000	+ 21234000
Brisbane	...	48,850	50,675	46,220	47,880	...	...	49,470	55,260	49,150	50,910	...	43	497,020	+ 25,100
British Columbia $	803,903	840,155	844,154	845,185	845,973	...	802,511	834,772	842,274	836,603	861,812	...	17	3,375,461	+ 6
Buenos Ayres L'c'z	51,071	51,944	55,873	55,873	58,492	58,058	52,642	57,227	55,873	58,492	61,111	63,119	21	295,823	+ 15,582
Burma ... Rs.	54,275	43,764	55,168	58,974	64,778	...	61,823	61,637	57,864	61,829	66,423	...	13	186,116	+ 7,196
Cape Town ...	25,038	25,571	25,164	25,755	26,839	...	24,638	26,046	24,970	25,760	26,220	...	—	—	—
Carthagena & H. ...	1,410	1,936	1,773	4,244	3,862	1,717	1,174	2,257	1,880	1,721	3,182	2,18[illegible]	47	26,175	– 1,640
Cordoba	...	23,129	23,616	23,841	...	...	26,622	27,118	27,926	...	...	...	21	132,661	+ 16,462
East India ...	4,494	4,591	4,513	4,154	4,084	...	3,640	3,859	4,069	3,612	3,727	...	13	11,408	– 1,343
Kalgoorlie... ...	2,308	2,350	2,652	...	...	...	2,437	2,498	3,090	...	...	...	34	19,802	+ 2,512
La Plata	5,187	5,425	5,811	5,930	6,587	6,453	5,883	6,643	6,470	7,286	7,286	7,375	47	73,862	+ 15,763
Manila ... $	310,559	305,126	297,128	322,212	323,108	...	291,434	291,093	298,788	296,842	313,943	...	43	2,955,269	– 101,151
Monte Video ...	42,960	42,411	44,672	44,927	47,297	...	44,298	48,672	46,463	48,372	51,825	...	52	567,123	+ 11,400
Para	22,833	22,605	20,890	20,175	23,498	...	23,942	23,862	24,050	24,932	26,471	...	47	259,415	+ 13,202
Port Elizabeth ...	6,180	6,515	6,324	6,477	6,788	...	6,412	6,623	6,578	6,424	6,638	...	—	—	—
Rangoon ... Rs.	130,000	133,536	133,000	132,225	151,000	145,500	140,400	140,250	137,738	141,800	155,841	148,850	47	1,568,637	+ 77,866
Vera Cruz	...	57,600	54,500	66,900	...	...	...	46,100	32,700	43,200	...	...	39	425,100	– 92,300
Winnipeg ... $	432,894	390,109	393,823	417,174	441,315	...	405,688	397,684	399,498	426,362	459,097	...	44	4,387,601	– 45,490

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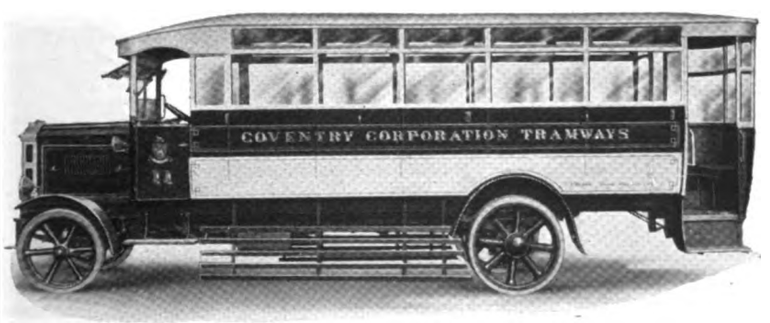

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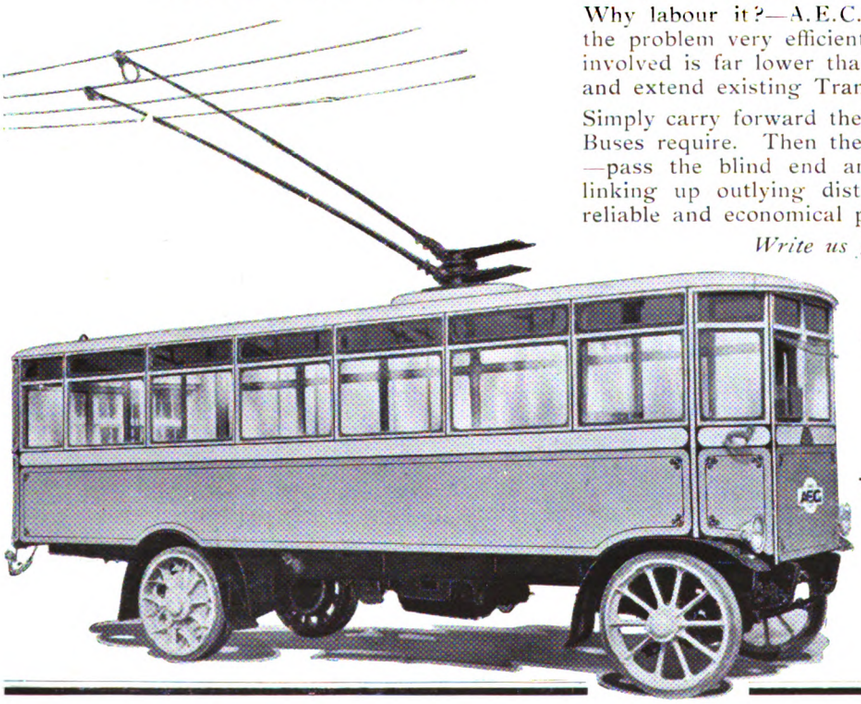

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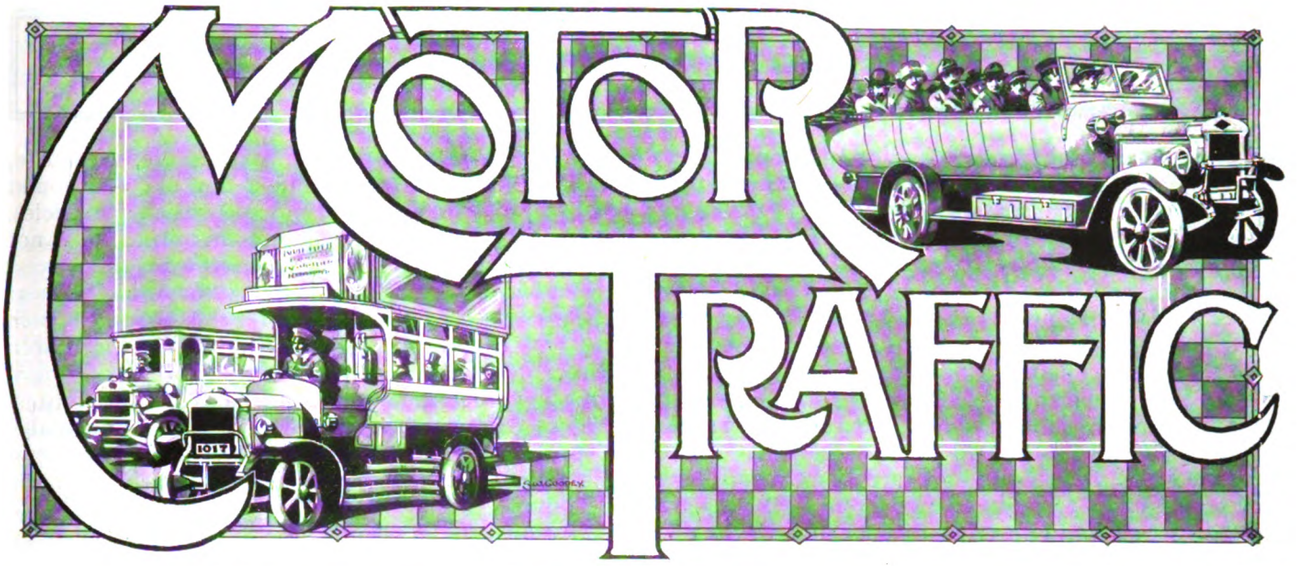

MOTOR TRAFFIC SECTION—SEVENTEENTH YEAR OF PUBLICATION.

PAY-AS-YOU-ENTER OMNIBUSES.

From time to time we have directed attention to the possibilities of the one-man operated tramway cars and omnibuses for service where the traffic is not sufficient to warrant the running of the heavier type of vehicles. If these possibilities are fairly considered we believe they will be found to be greater than is generally supposed. Many comprehensive schemes of tramway and omnibus development planned in pre-war days have had to be considerably modified or entirely abandoned on account of the greatly increased cost of labour and materials. As a result a large number of outlying districts and communities are still without the means of transport which are essential to their development. In industrial centres where a large traffic has to be provided for, and full loads can normally be expected, the large carrying capacity of the tramcar and double-deck omnibus are required, but in more thinly populated areas, and for the purpose of feeding tramway services, as well as linking up the outlying terminals, the moderate sized omnibus capable of being efficiently operated by one man has undoubtedly a future. Experience has shown that given regularity of service at reasonable fares a wide field can be profitably exploited by these economical vehicles in the neighbourhood of every large town in the kingdom. It will therefore be seen that apart from the advisability of adding vehicles of this type to the fleets of large carrying capacity already in service, with a view to raising the percentage of occupied seats per vehicle, there is a wide scope for the development of passenger transport systems on undeveloped routes. Many useful types of the one-man omnibus have already been illustrated in our columns, and the descriptions of two of the latest productions, which appear elsewhere in this issue, are of considerable interest.

MUD SPLASHING.

The universal opinion of all practical motorists appears to be that the recent splash guard trials organised by the Royal Automobile Club were abortive, and served no useful purpose. It is not disputed that with the largely increased number of motor omnibuses and other heavy motor vehicles constantly running in the densely populated districts of our towns and cities mud splashing has become a decided nuisance to pedestrians, and any device tending to minimise the trouble would be welcomed by all concerned in proportion to its effectiveness. Unfortunately the conditions under which the vehicles—more especially omnibuses—are operated, leave little opportunity for the fitting of attachments, the presence of which are necessary to arrest the spread of the mud displaced by the wheels. It should be a comparatively simple matter to prevent mud splashing on normal roads if it were possible to operate the vehicles clear of all obstruction, but the most effective mudguard would have an extremely short life when brought into contact with a 6-inch kerb. Freedom from mud splashing when negotiating pot-holes such as were created for the R.A.C. trials is neither to be expected or desired, for the authorities can generally be relied upon to keep their roads in such a condition that such cases would prove the exception rather than the rule. What is desired is a device that can be relied upon to reduce mud splashing to a minimum on an ordinary muddy street where the traffic conditions are such that the cleansing arrangements are confined to the night hours, as in the City of London. We are convinced that much could, however, be done to mitigate the nuisance by road authorities whose cleansing arrangements do not compare favourably with those mentioned. Clean streets are after all the real solution.

MOTOR VEHICLE TAXATION.

The only point upon which all classes of motor vehicle users unanimously agree is in believing that the figure of £10,250,000, the sum demanded by the Ministry of Transport as net revenue from the industry, is excessive. The advocates of the substitution of a fuel tax in place of the present system of horse-power tax must be alive to the fact that all kinds of complications and evasions would occur. These must follow in view of the suggestion in their own memorandum that petrol should be duty free for aviation, motor boats, cleaners' and other trades using it for purposes other than the running of road vehicles, to say nothing at the moment of the possibility of motor

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MOTOR TRAFFIC

spirit importers taking advantage of the opportunity to supply an inferior grade of spirit to that imported, and upon which the duty was charged. At the same time they strongly maintain the unfairness of an equal tax upon vehicles irrespective of their value or miles run, and regard it as most damaging to the motor industry. With regard to the industrial section, the position of all the large motor transport companies and owners of motor omnibuses broadly stated appears to be that they would rather continue to pay the present taxes than readjust the whole of their rates and calculations which the introduction of a fuel tax would involve, while a large number are very definite in their opposition to any change from the present system. There is no question that a reduction in the tax would greatly benefit the industry as a whole, as in many cases it would induce owners to retain a larger number of vehicles in service instead of reducing to the minimum consistent with the full load principle. As the industrial section of motor users contribute an equal amount to the revenue as the owners of private cars, it is obvious that if the full weight of their influence is to be joined to that of the latter body for the purpose of obtaining a reduced scale of taxation in future legislation, they must agree upon some principle which will be acceptable to the whole of the motor community.

THE FASHION IN MOTOR VEHICLES.

Recent events have certainly shown a marked variation in policy between the branch of the motor industry manufacturing private cars and that devoted to commercial and public service vehicles. The former has, perhaps, always been a little too much inclined to follow the dictates of fashion. The latter, on the other hand, has possibly erred in the opposite direction. During the last year or two the adoption of the new system of taxation, coupled with the comparative poverty of a big section of the car-using public, has helped to make the light car the fashion. Quite sound powerful cars have fetched absurdly low prices on the second-hand market. New productions in the shape of very light cars have been well received by the public, and the result has been that manufacturers, considered generally, have rather rushed to extremes, and it may well be found in the near future that there is something of a glut of the lighter classes of vehicle. Meanwhile the pendulum of public taste may swing over to some degree. Already some people have gone back to their old belief in the somewhat heavier and higher powered type of car, despite the bigger operating costs that it involves under some headings. Their view is that this type is more inherently reliable, and that, when everything is taken into account, the difference of running cost is not so considerable as would be supposed. In the commercial vehicle industry the war brought about over production of the heavier types, which were almost exclusively demanded for British military purposes. The comparatively light van was of necessity more or less neglected, and the line of least resistance after the war was to continue on something approximating to the war-time class of output. This state of affairs gave a big opportunity for light low-priced vans of foreign origin to become popularised in this country. On the whole, the British industry has been slow to reply to this attack. The difficulties are, of course, considerable, unless we abandon our old and sound principle of building durable and reliable vehicles. The trouble is that adherence to this principle is not compatible with cutting down prices to the lowest imaginable level, and this last method would appear to be necessary if we are to counter the foreign invasion directly. Up to the present, the counter has been indirect. A number of British manufacturers are now marketing what they believe to be about the lightest type of commercial vehicle that is really practicable for prolonged and regular service. They have not gone so far as their foreign competitors in the direction of lightness or low first cost. Perhaps direct competition on these grounds is impossible; perhaps, again, it is undesirable. It may be that traders will presently come to the conclusion that it is better to pay more for a more substantial and more durable machine capable of carrying a somewhat heavier load when necessary, even though this need may only seldom arise.

OMNIBUS REGULATIONS.

The conditions under which motor omnibuses are operated differ widely in various parts of the country. In a number of provincial areas the provision of large seating capacity appears to be the only consideration, irrespective of total weight or space per passenger. From the point of view of the crowd, anxious to be carried a comparative short distance with the least possible delay, much may be said in favour of this system, but considerations of a much more serious character obviously point to the necessity for fixing a limit to the size and weight of all passenger carrying vehicles. In London the maximum weight as well as the principal dimensions have to conform to the conditions laid down by the Public Carriage Department of the Metropolitan Police, and although there was a great outcry on the part of certain chassis manufacturers against what was termed the arbitrary action of the police authorities when their regulations were first introduced, experience has shown that these regulations were undoubtedly based upon intelligent anticipation of the possibilities of the industry when faced with the necessity of improving designs. For reliability, absence of noise, comfort for the passenger and low unladen weight London's omnibuses to-day compare most favourably with any in the world. The maximum loaded weight permitted in special cases has been 8 tons 10 cwt., which enabled a seating capacity of 56 passengers to be arranged for on a double deck omnibus. Although no mention is made of the number of passengers that may be carried in future, we understand that for all new vehicles the total laden weight is now to be restricted to eight tons. This new regulation is evidently framed with a view to discourage the building of omnibuses of excessive carrying capacity for London services.

ABOLITION OF THE MINISTRY OF TRANSPORT.—The Prime Minister has stated that the question of what Ministries could be abolished was engaging the attention of the Government, and every effort was being made to secure economy in this direction. It had been arranged that the Ministry of Transport should be abolished at a definite time, but they were considering whether that date could not be hastened.

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MOTOR TRAFFIC

THE OMNIBUS IN THE COUNTRY.

AN ABSTRACT FROM A PAPER BY MR. S. E. GARCKE.

At a meeting of the Institute of Transport, on December 4, Sir Lynden Macassey, K.B.E., K.C., one of the vice-presidents, being in the chair, a most interesting and informing paper on "Passenger Transport by Road in Rural Areas" was read by Mr. Sydney E. Garcke. By the courtesy of the Institute we are able to extract from the paper the following—

When dealing with the broad question of the conveyance of passengers in country districts the conclusion cannot be avoided that for quite rural services there exists no practical alternative to the omnibus. One of the chief problems in connection with the further development of country omnibus services is the difficulty of adjusting the size of the unit in relation to the traffic. It has to be remembered that the operation of cars to a time table, often necessarily set at long intervals, is an essential feature of the rural service. On a town system the problem can never become so acute, because where the interval between cars is short, it is practicable to make the passengers to some extent adjust their requirements to the service given. In that case the cars are operated on a headway as distinct from a time table, and the headway is usually of short duration, so that the passengers surplus to the carrying capacity of a particular car can reasonably be asked to wait for the next. On the other hand, in the case of the rural service connecting villages one with another or with the nearest market town or railway station, the time table will of necessity often be so fixed that a passenger left over from one car may have to wait for a matter of hours for the next. On a very large number of rural services there are but three, or perhaps four, journeys in each direction daily. It will be apparent that the question of the carrying capacity of the unit, and therefore of the overall dimensions of the vehicle, is one that at all times draws the anxious attention of those who are responsible for the supply of purely rural facilities. For such services it is clear that the size of the unit adopted must always be dictated by the maximum load. Experience shows that the maximum strain on the carrying capacity of the car does not necessarily occur on the same journey each day, or even on the same day each week, so that it is not practicable to overcome the difficulty of finding room for the maximum load by running duplicate cars at certain times; and even if in a few cases it could be done, the adoption of this remedy would result in the labour and capital charges becoming disproportionate to the revenue and the services would either become unprofitable or the fares would have to be substantially increased.

A census of loading has often been taken on country omnibus routes, and it is very surprising to note that, in cases where the journey is unprofitable, and even sometimes where the whole service is being worked at a loss, overloading occurs quite frequently and to a serious degree. While the average load is low, accounting for poor financial results, the maximum is high. The following examples taken from actual service will serve to illustrate the point. The routes from which these examples have been taken were selected because of their poor working results. They are typical of many others.

CASE A.

Duration of census, one week.
Type of service.—Connecting several high-class residential settlements and country villages with market town.
Seating capacity of omnibus, 28.
Number of single journeys performed in the week, 100.
Journeys on which overloading occurred, 14.
Journeys on which the load did not at any time exceed half the capacity of the car, (i.e., 14 passengers), 35.
Maximum load on any one journey, 38.
Lowest maximum load on any one journey, 0 (twice during week).
Result of working of service for week—revenue just balanced expenditure.

CASE B.

Duration of census, one week.
Type of service.—Connecting agricultural and mining villages with a seaport.
Seating capacity of omnibus, 28.
Number of single journeys performed in the week, 98.
Journeys on which overloading occurred, 5.
Journeys on which the load did not at any time exceed half the capacity of the car, (i.e., 14 passengers), 77.
Maximum load on any one journey, 47.
Lowest maximum load on any one journey, 0.
Result of working of service for week—revenue did not balance expenditure.

These arguments lead to the conclusion that, whatever uses the small 14-seated vehicle may have in connection with an urban service where the cars operate at frequent intervals, its utilisation in connection with the traffic generally experienced on ordinary country services cannot be expected to be a success. It is often argued that the small car may be valuable for the development of country routes pending the building up of sufficient traffic to justify the adoption of the unit of normal size; but statistics relative to undeveloped and unprofitable routes such as those just given, coupled with the accepted fact that the cost of operation of the small car, invariably mounted on pneumatic tyres and run at a high average speed, is only less than that of the large to a relatively small degree, should be sufficient to show that the argument in question is fallacious.

The rural omnibus proprietor is constantly endeavouring to enlarge his vehicle. He must do so in order to develop the less profitable routes on which he cannot possibly afford to run duplicate vehicles every time he has a small rush of traffic. A large unit is a necessity in his eyes in order also that he may be in a position to meet the demand, which economic conditions will undoubtedly bring about, that a return shall be gradually made to fares approximating to those of 1914. Now the enlargement of the unit so as substantially to augment the carrying capacity involves exceptional difficulties of a practical nature in the case of the average provincial system. In the metropolitan area the difficulty has been overcome by the adoption of a vehicle with the seats arranged on two floors, each floor carrying nearly as many persons as the single-deck vehicle hitherto adopted for country service, but on a majority of provincial routes, expecially those passing through the purely rural areas with which we are here more particularly concerned, the use of a car of the double-deck variety could only be attended with danger to the passengers and to the public at large, on account of heavy road camber and the overhanging of trees so often encountered on all but the most important roads. On many rural routes the use of this type is in fact not merely inadvisable but a matter of physical impossibility on account of the low bridges so often encountered.

The designer of an omnibus intended for country service, being called upon to enlarge the present type of single-deck vehicle, endeavours to add to the total length, but finds that he is limited by considerations of overhang. It is proposed to embody in legislation the now generally accepted practice of limiting the overhang to seven twenty-fourths of the overall length, and as the overall length will also be limited to something only slightly in excess of that of the most up-to-date single-deck omnibuses now in use, there is a tendency, in order to bring about the necessary increase in the carrying capacity, to utilise the double-deck vehicle wherever possible, even in cases where the roads are not really suitable for this type. This regrettable situation could not be righted by a mere increase in the permitted overall length, as with the many narrow roads, especially those with sharp curves, which occur in our old country towns and villages, a longer vehicle is not practicable pending the development of the six-wheel chassis, a development which should surely receive some official encouragement. in contemplated legislation. The six-wheel omnibus, be it noted, is now in regular use in Paris. A trailer would do much towards solving the problem, as there are many country routes where the use of such a device would be attended by complete safety and where the traffic is of such a character as to require an enlarged unit on, say, only two journeys each day. On all others the trailer would be left behind. The trailer for passenger work is an old institution on the continent. In one case with which the writer was intimately concerned 36-seated omnibuses of the London type were fitted on the early morning and evening journeys with 16-seated trailers, making a 52-seated unit. The use of the trailers in question has been attended by no inconvenience, even though they were very largely utilised in urban areas. The objections to the trailer in this country appear to be founded upon considerations of safety. This is, however, entirely a matter of suitable mechanical design. This question, together with other problems of a mechanical nature, might with advantage be submitted to a small expert committee embodying some mechanical engineering element. It is a little difficult to understand why the trailer in connection with passenger work should be prohibited, while that used in connection with a goods vehicle is legalised. This difficult problem of capacity, upon the solution of which it is no exaggeration to say the whole future of rural passenger transport development is largely dependent, appears therefore to be along two possible lines—the development of the 6-wheeled unit or the utilisation of a trailer.

Before leaving the question of the size of vehicle, it will be appropriate to touch upon the question of tyres, a more important matter when considered in connection with services upon relatively inferior roads in country districts than it is when dealing with town routes. The shock occasioned by the passage of a large omnibus to passengers, roadway and roadside buildings may be mitigated by the adoption

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of more resilient tyres and springs. The former is the more obvious cure, and therefore the latter is often neglected. Much can yet be done by the manufacturer to improve the springing of public passenger vehicles both by reducing the unsprung weight and by re-designing the springs themselves, suiting them to passenger requirements instead of supplying to the omnibus proprietor a machine really designed for heavy goods transport. The pneumatic tyre has recently been drawing a great deal of attention. When fitted to a small vehicle, and when the owner is prepared to inflate to a pressure below that at which the longest tyre life may be obtained, it undoubtedly makes for smooth running. But against this great advantage there is the fact that the tyre introduces an additional element of unreliability, a factor that cannot be overlooked by the manager of a regular service run strictly to time table. The cost of the pneumatic tyre when applied to the standard car is at present from four to six times that of the solid tyre, and there is also the disadvantage of less reliability already referred to. On the other hand, there is the advantage of smoother running of the car; but with the heavy vehicle it is necessary to compress the air so much as largely to destroy the cushion effect. The solution of the vibration problem lies (apart from the improvement of road surfaces) in better springing, together with solid tyres of improved material and design, rather than in the adoption of pneumatic tyres on the heavier type of omnibus. The gradual adoption of smooth road surfaces in rural areas, as in urban, will do even more to solve the problem than the improvements in design and material just suggested, and the combined effect of all these factors will entirely remove the necessity of any drastic change in present methods.

The proposal to carry the load upon a greater number of axles, as would be the case if either the 6-wheel long coach or the trailer were to be legalised for passenger work, should be very welcome to the road engineer. The adoption of either system by reducing the axle weight would substantially contribute to the solution of the problem of adequately maintaining the roads. The country omnibus manager is more intimately concerned with this question than his town colleague, as his services generally have to traverse many sections of inferior road. As a rule he is blamed for much damage that he does not do. He is the victim of his own publicity. The agricultural vehicle, the goods haulage wagon, the private motor car and the horse vehicle all use the roads a great deal, but all of them go about unostentatiously. The omnibus service, on the other hand, is run in the most public manner possible. The cars are all brightly painted in a uniform colour. Bills everywhere advertise them. The public not only see them, as in the case of other road vehicles, but they also ride in them. They are therefore constantly in the public mind. In short, the impression is created that the omnibus services more or less monopolise the road. The provincial companies have been so successful in advertising their services that the road authorities as well as the public have been deceived into imagining that the omnibus is already a greater factor in the problem of excessive road wear than it is ever likely to be. Evidence of this is frequently obtained when a road authority will complain of the rapid deterioration of a particular road, and from the statements made it can be judged that they attribute their trouble primarily to the omnibus service. In such cases the company concerned has usually ascertained the true facts by taking a census of vehicles, and in many instances it is found that the omnibus traffic is a very negligible part of the whole. In fact, in some cases where in all seriousness complaint is made, the omnibus runs but two or three return journeys per day, a quite usual circumstance in rural areas. It is to be hoped that no attempt will be made further to burden rural road passenger transport at the present time.

Most of the more obvious country omnibus connections are already established; but many connections between out-of-the-way agricultural villages and the nearest town or railway station remain to be opened, and are very necessary in the interests alike of the country resident and the railway system. These routes, however, are generally unremunerative for the first year or two; and for some time after that yield an altogether insufficient return. The pioneer is discouraged from starting such services by the absence of any certainty of tenure. As the law at present stands, an omnibus company is free to develop a new service practically as it chooses, for in rural areas even the formal licence to ply for hire, as required in a borough, is dispensed with. So long as the service is obviously unremunerative it is certain that no competition will occur; but as soon as the traffic has grown sufficiently to yield even a very small return on capital the pioneer is liable to unrestricted competition. Why be a pioneer? Surely it is much easier to wait while someone else goes through the years of unremunerative effort, and then be a pirate? This quite natural argument means stagnation. Some licensing authorities, recognising the threat to the continuance of the orderly services which they enjoy, limit the number of licences which they will issue. Many see the danger of unrestricted and uncontrolled competition, but fear to risk the possibility of an appeal by the disappointed applicant to the Minister of Transport. Others, fortunately in a small minority, take the short-sighted view that the more competition the better for the travelling public. The services operated in the districts of these authorities afford a demonstration of how public services should not be conducted. More official enlightenment is required as to the grounds upon which a local authority may and should refuse to licence. The unfairness of the present method of control over public passenger services and the consequent discouragement to the pioneer is not the only or most serious objection to it. The chaotic service conditions which follow the introduction of unregulated competition is a very serious matter from the public point of view.

The essence of success in building up a country public service is the unfailing and punctual operation of a carefully thought out time table. A well run public service will, over a course of years, develop a public connection for particular departure times. Now when a competitor commences to operate on an already well-established route, he naturally runs at the time that will pay him best—shortly before those of the established omnibus service. The company operating the service must protect itself against this sort of piracy, and in its endeavour to do so abandons the regular service time table; the public suffer in consequence, and the whole thing becomes chaotic. To devise means whereby the services of the two or more proprietors do not clash is no solution, because if the original service were sufficient for the needs of the route, then a second proprietor's service means that it must be overdone. Neither will pay, and it is almost unnecessary to say that that result cannot be in the general interest. If the original proprietor be called upon to withdraw a number of his journeys to make room for the second comer, then others will be encouraged to start, seeing that it is so easy to obtain a share in an already established business. Moreover, the division of a small route between two cars, when one would suffice, spells inefficiency on account of low mileage per car per day, high cost and high fares. In the end it comes to this—that a public passenger service run to time table does not respond in the normal manner to the economic laws of competition, and in the interests of the travelling public, to say nothing of the investor, it is necessary that some authority should be exercised to the end that a reasonable amount of protection shall be accorded those pioneers who give an adequate and satisfactory service. This principle seems to have been accepted in the legislation which brought about the recent railway amalgamation. It is an interesting comment that, so far as the writer has been able to ascertain, Great Britain is the only country where a proprietor may place a public conveyance upon a road without regard to present services, and in rural districts entirely without a licence or any restriction whatever. The general practice of other countries is to grant a concession handing over to one proprietor the sole right of providing the public service for a term of years, subject to adequate safeguards as to sufficiency and quality of service rendered.

A closely allied matter is that of securing the proper maintenance of the vehicles. In Greater London the Metropolitan Police exercise an authority by virtue of special powers which, in the past, has not only provided an incentive to the development of the present advanced design of passenger vehicle, but has also secured that the vehicles shall remain at all times in an efficient state of repair. In the provinces only the large boroughs make genuine inspection prior to licensing; and even in these cases they cannot take any effective steps to secure that the vehicles shall remain in the same condition during the year of currency of the licence as it was when the inspection took place. The small country towns sometimes make an inspection prior to the granting of the annual licence; but the number of cars to be passed each year does not justify the appointment of properly qualified inspectors, and the absence of anything in the nature of standard regulations as to the type and construction of cars, which might act as some guide to the local committee and inspecting officials, generally results in the inspection degenerating into a formality of no avail against the irresponsible proprietor of one or two cheap, unsuitable and ill-kept machines, while it is merely an irritant and waste of time to the responsible omnibus companies who can usually be relied upon to present vehicles in good condition. In rural areas there is no inspection or licence at all.

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The result of our peculiar system is that, though this country is the home of manufacture of the world's best heavy motor cars, there are hundreds of public passenger vehicles of an unsuitable type, maintained only to a thoroughly unsafe standard of mechanical efficiency and operated without time table to the detriment of the properly constituted public services. The whole thing results in some provincial districts being in a state of affairs that would be regarded as intolerable in other civilised countries.

The cure would appear to be either in the adoption of the continental franchise, a system very difficult of application where there are already a considerable number of proprietors on a single route, or in the adoption of a more judicial attitude by a licensing authority. The grant of licences should be refused more frequently than at present on the ground that a particular route is already adequately served by cars operating to a properly observed time table, or that the car presented is unsuitable or badly maintained.

Public services by omnibus cannot be operated without some considerable expenditure on garages, plant, spare parts, and, perhaps most important of all, spare vehicles. It is obvious that this expenditure is disproportionate to the cars owned by the quite small proprietor. It becomes equally obvious that the business is not a suitable one for the quite small capitalist.

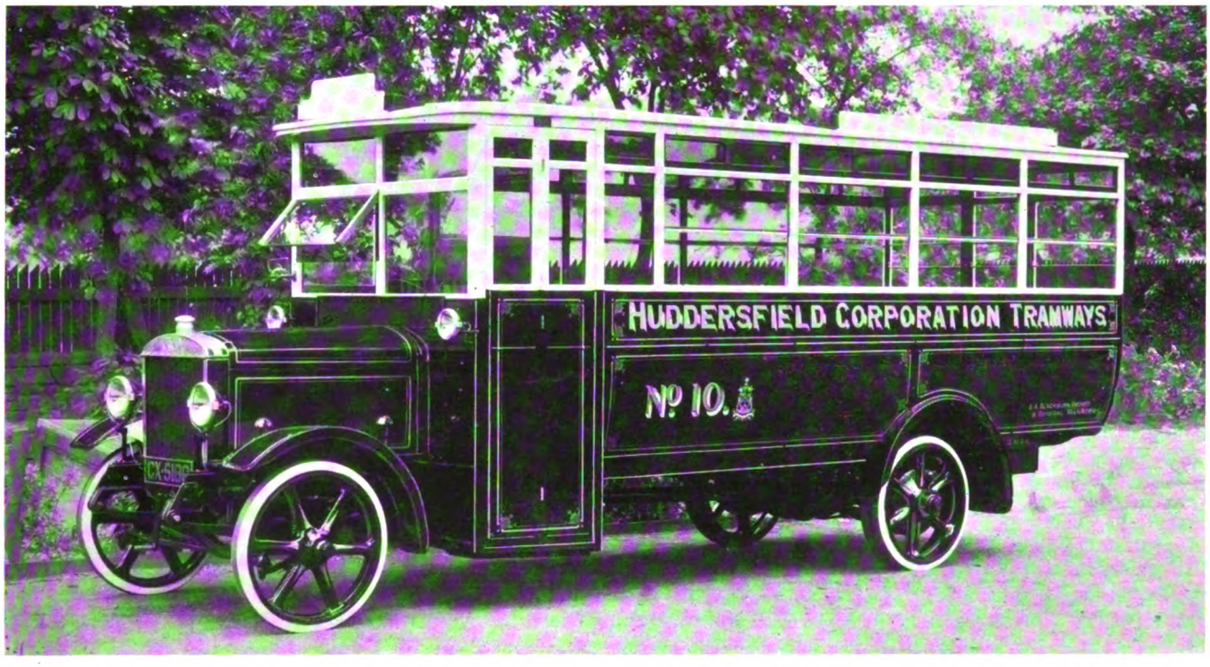
As to the future, much depends upon the skill with which the obsolete law governing the industry is remodelled. He would be a brave man who attempted at the present time to forecast the exact position to be occupied by the rural omnibus of the future. A good deal depends upon the engineering development of the machine itself. The vehicle of from ten to twelve years ago is now entirely obsolete. It is doubtful whether the design of to-day will be quite out of date ten or twelve years hence. The older an engineering development becomes the slower the rate of progress. Railway engineering progress has now slowed down; the locomotive, developing very rapidly the best part of a century ago, now changes from year to year only to an almost imperceptible degree. The tramcar is almost stationary, and appears to have reached at least its penultimate stage. The engineering development of the motor omnibus is slowing down, but much will still be done in the direction of so improving design as substantially to reduce the cost of operation. This factor may enable the omnibus of the future to be used for services at present economically impossible; and thus the omnibus movement may play a more important part than is apparent at the moment. One fact only is clear—that for many a year to come the rural omnibus will be a substantial element in the British transport system.

HUDDERSFIELD ADOPTS 20-SEATER "ONE-MAN" MOTOR OMNIBUSES.

Huddersfield Corporation commenced the operation of motor omnibuses as feeders to its tramway system in December 1920. The first purchase was that of seven 4-ton 50 H.P. "Karrier" chassis, on which were mounted two double-deck bodies seating 40 and 47, and five single-deck bodies each seating 30. The district over which these vehicles have operated is very hilly, and during the twelve months ending March 31, 1922, the working expenses per mile, excluding financial charges, were 19·38d.

With the continuance of trade depression, it became increasingly evident that to prevent the vehicles from becoming a charge on the undertaking it would be necessary considerably to reduce operating expenses. From careful analysis of the flow of traffic on the several routes, it was found that in many cases a vehicle of smaller seating capacity would be capable of coping with the passengers, particularly on the morning services and the afternoon services up to 4 p.m.

In May last it was suggested that other omnibus routes for which Parliamentary powers had already been obtained should be opened, and it was decided, after extensive investigations into the running costs of lighter types of vehicle, to purchase three 20-seater one-man operated omnibuses, two of the "Guy" 2-3 ton, 30 H.P. chassis, and one of the new "Karrier" 2-3 ton, 30 H.P. chassis.



One-Man Motor Omnibus Used by Huddersfield Corporation as Feeder to their Tramway System.

The bodies of these vehicles, which are shown in accompanying illustrations, have been constructed by the Blackburn Aeroplane and Motor Company, Limited, at their Leeds works, to the design of Mr. A. A. Blackburn, general manager and engineer of Huddersfield Corporation Tramways. The framework is of selected ash, reinforced with W.I. plates, and the panelling of mild steel No. 22 S.W.G. The unladen weight is 3 tons 5 cwt.

The floor of the omnibus is 2 ft. 9 in. from the ground, the front entrance, with its three steps, being specially easy of access. The entrance is governed by a folding door, which when closed fits flush with the body, making it impossible for passengers to board whilst the omnibus is in motion. This door is operated by a lever within convenient reach of the driver, giving him complete control over the ingress and egress of passengers, and accordingly reducing to a minimum the possibility of platform accidents. The vehicle has, of course, the usual emergency exit at the rear.

The P.A.Y.E. system of collecting fares is employed, a wooden cash box, with three bowls, along with a receptacle for the ticket rack, fitted to the right of the driver, enabling him to collect fares

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without leaving his seat. Two of the vehicles have been in operation for the past three months with entirely satisfactory results, as may be seen by the following comparative figures.

	32-Seater Omnibus per mile—d.	20-Seater Omnibus per mile—d.
Drivers' and conductors' wages ...	4·91	2·50
Uniforms	·13	·06
Petrol	4·28	2·92
Oil	·61	·15
Accident insurance	·27	·18
Licences	·55	·32
Depreciation (at 20 per cent.) ...	3·01	1·98
Interest on capital	·91	·59

No statistics for repairs and maintenance are given in view of the fact that the one-man omnibuses are new, whilst the heavier vehicles have been in service nearly two years. Comparison therefore would be apt to mislead.

The most salient feature of this type of vehicle is, of course, its low cost of operation, and this makes it possible for services to be accelerated where with a larger type of omnibus the cost would be prohibitive. Some routes on which one omnibus can provide a 40 minutes' service are adequately served every hour, and it is accordingly only necessary for the omnibus to be run two-thirds of its period in service. In such cases the advantages of a one-man omnibus are manifold.

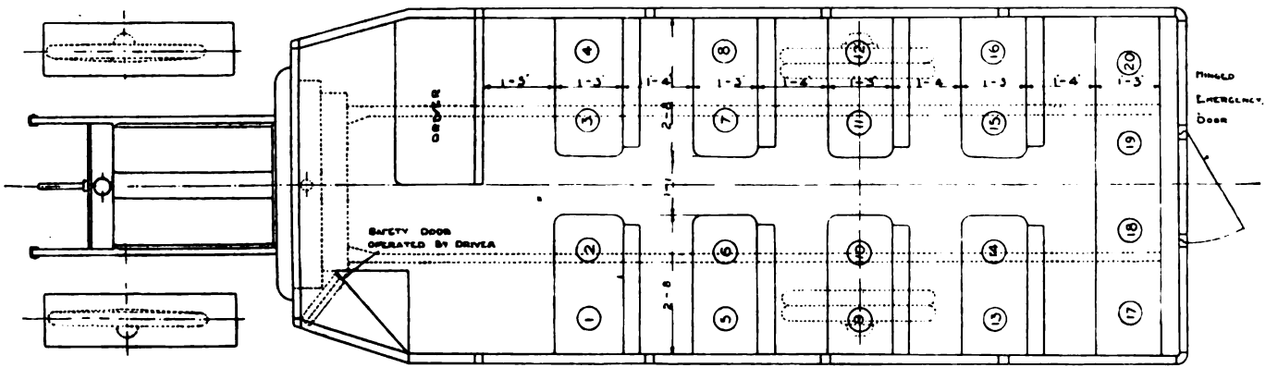
Large omnibus concerns are painfully aware that the cost of operation, maintenance and repairs to their vehicles are regulated to a great extent by the condition of the roads, and the lighter omnibus has been specially constructed to withstand excessive vibration. It is well sprung, and so efficiently absorbs shocks given by bad roadway that tribute has been paid to the comfort of the travelling by passengers who had been accustomed to the heavier omnibus.

It is indisputable that before hope can be entertained that omnibuses will ever attain the popularity of tramcars the fares must be reduced, especially where there is any competition with train services which afford contract facilities, and therefore secure the cream of the traffic, *id est*, regular passengers. This is a traffic which forms the bed-rock of a service, and before it can be established the necessary inducement of cheaper fares must be offered. It is a traffic more particularly essential to the financial success of municipal undertakings than privately-owned undertakings, for the incumbency of municipal control compels the former to adhere to whatever time tables they publish, but the latter, it is frequently found, can and do resort to making an extemporaneous cut of any journey which they discover will not prove remunerative.

That omnibus fares have already reached, if not actually exceeded, the economic limit is evinced by the substantial losses shown by so many financial statements of municipal concerns published for the past year's working. The reduction in the cost of operation effected by falling prices of materials and wages is more than counterbalanced by the falling off of an abnormally heavy traffic which the war, responsible as it was for the rapid expansion of omnibus passenger transportation, led us to expect.

The remedy now lies in running vehicles built to a scale correspondingly modified to the traffic in making operating expenses compatible with the earning capacity—not in leaving falling markets to "readjust" the position whilst postponing a revision of fares; hence the introduction of the one-man omnibus.

Passenger Receiving a Ticket in One-Man Omnibus.



Plan of One-Man Omnibus—Huddersfield Corporation Tramways.

London County Council and Road Vehicle Regulation.—Reporting on the regulation and taxation of road vehicles with special reference to the second interim report of the Departmental Committee appointed by the Minister of Transport, the General Purposes Committee of the London County Council express the opinion that fire appliances and motor ambulances should be classified as "exceptional vehicles," and, when responding to a summons, excepted from the suggested speed limits. Further, that the removal of the motor speed limit would have the effect of increasing the number and seriousness of accidents to pedestrians passing between the pavement and stationary tramcars.

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NEW TYPE OF VULCAN OMNIBUS.

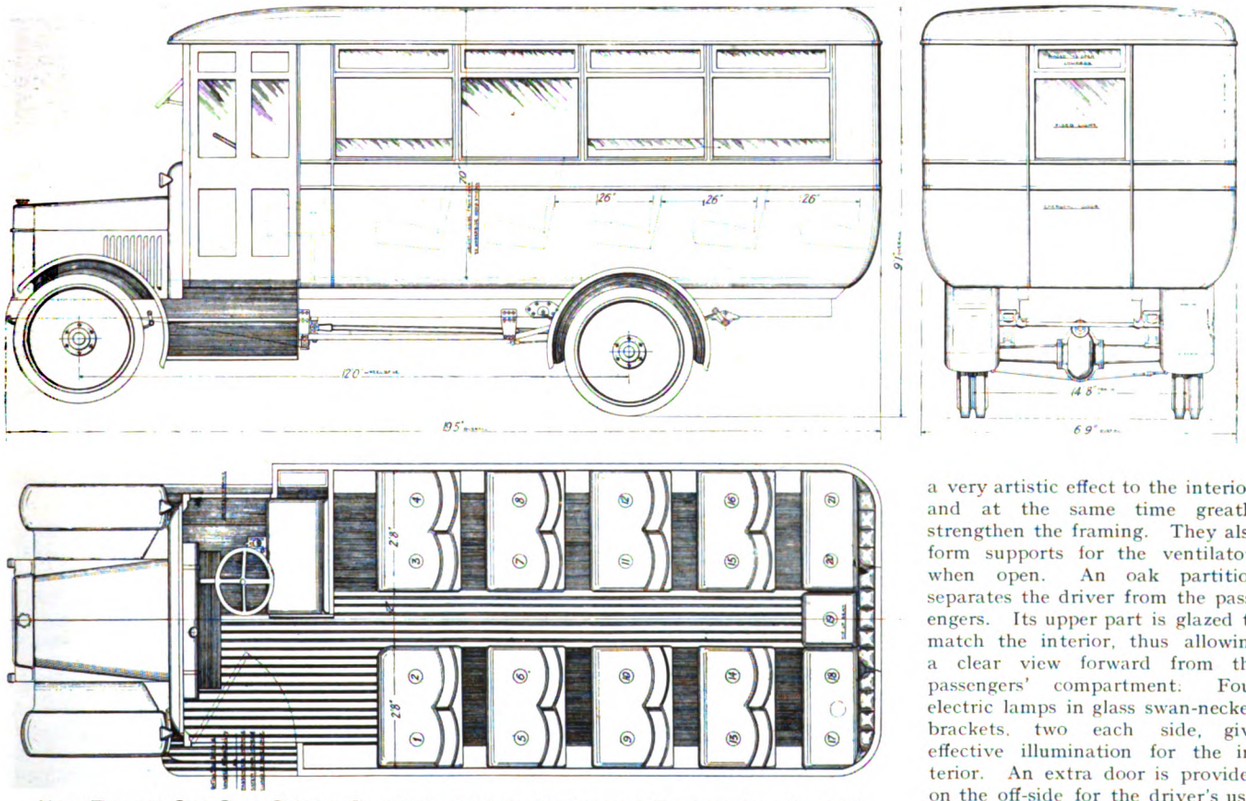
Vulcan Motor and Engineering Company, Limited, of Southport, have just added to their range of utility vehicles a standard 21-seat saloon omnibus and a 4-ton six-wheel commercial wagon, each of which merits attention. The omnibus is described below, and elsewhere in this issue the six-wheeled vehicle is dealt with. It has been generally recognised that with the high cost of operation inseparable from the running of large double-deck omnibuses every effort should be made so to organise the services that these vehicles should only be used when the traffic is sufficiently dense to give reasonable prospect of full loads. During slack periods and on routes where the traffic is light there can be no question that a reliable single-deck omnibus that can be successfully operated by one man will best serve the situation with economy and efficiency. It is with the object of meeting the growing demand for the "one-man" vehicle that this omnibus has been produced.

The new Vulcan single-decked saloon omnibus has been designed for operation without a conductor. A special feature is the safety entrance door at the front end, this being opened and closed by the movement of a lever operated by the driver, who also collects the fares. The deep domed roof and the ample turn under of the body makes it a most attractive looking vehicle, while the closed-in front ensures protection from the weather both for the passengers and the driver. Accommodation is provided for 21 passengers to sit in comfort; the seats are of the semi-bucket type, each seating two passengers with the exception of the rear seat, which extends the full width of the body, and seats five passengers. All the seats face forward, and are fitted with well sprung detachable cushions upholstered in red leather cloth.

Four large windows on each side are fitted with frameless glasses, and they can be raised, lowered, and fixed in any desired position by means of leather straps, the glasses sliding in silent felt-lined channels. Above these windows are four ventilating lights, which are hinged and open inward. An emergency door is provided at the rear of the vehicle, and is fitted with a fixed window and hinged ventilating light of similar sizes to those at the side. This is controlled by a quick-acting release fitting operated by a small hand lever. The middle section of the long seat is hinged, and can be folded over in order to give a free passage through the emergency door.

From floor to waist-rail the body is lined with plywood, the whole interior being finished in oak, stained and varnished. The roof is lined with white "Lincrusta," and divided into eight panels by dark oak mouldings. Oak brackets of a special scroll design are fitted at the junction of each pillar with the roof; these, in conjunction with the parallel domed roof and dark mouldings, give a very artistic effect to the interior, and at the same time greatly strengthen the framing. They also form supports for the ventilators when open. An oak partition separates the driver from the passengers. Its upper part is glazed to match the interior, thus allowing a clear view forward from the passengers' compartment. Four electric lamps in glass swan-necked brackets, two each side, give effective illumination for the interior. An extra door is provided on the off-side for the driver's use. This is fitted with strong slam lock with interior and exterior handles. An oval-shaped side light is fitted in the driver's compartment, giving an uninterrupted view to the side and adding to the exterior appearance.

Vulcan 21-Seat Omnibus.



New Twenty-One-Seat Saloon Omnibus—Vulcan Motor and Engineering Co. Ltd.

The entrance steps are covered with aluminium treads and edging and fitted with end shields completely protecting the steps from mud splashes; a novel feature being that the bottom step is auto-

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matically raised when the door is closed, and lowered again when the door is opened, this movement being controlled by an attachment in the form of a cranked lever attached to the bottom of the door.

The chassis upon which this omnibus body is mounted is fitted with a four-speed engine, 95 mm. bore, 130 mm. stroke, 22·4 R.A.C. rating. This has a large diameter hollow crankshaft, through which oil is forced by means of a gear-driven pump to the journal and connecting rod bearings. The valves are arranged on the near side, and are operated by means of adjustable tappets; they are enclosed by an easily detachable cover. The radiator is of the gilled tube type, with top and bottom tanks of large capacity, the circulation being maintained by means of an efficient water pump. The gear box provides for four speeds forward and a reverse, with central gate change. A flexible disc universal joint is provided between the clutch and gear box. The main universal joint is the compound type of the cross pin pattern, with ample provision for lubrication. The final drive is by worm and worm wheel, the rear axle being of the full floating type. The worm wheel and differential are carried on heavy duty ball bearings. Powerful independent brakes are provided, the foot brake acting externally on a drum behind the gear box, and the hand brake internally expanding on 18-in. drums mounted on the rear wheels. From the drawings of the plan and elevation it will be seen that all the dimensions are on the most generous scale, and that a really comfortable vehicle has been produced that should find considerable favour with all concerned in passenger transportation.

MOTOR TRANSPORT YEAR BOOK.

A glance at the sixth annual issue of the Motor Transport Year Book and Directory (The Electrical Press, Limited, Fisher Street, W.C.1, 22s. 6d.), serves to set the reader wondering at the astonishing growth of the motor transport industry. The total number of undertakings recorded in the issue for 1921–22 is 3,030, as compared with 617 in the inaugural volume. The increase over 1920 is 1,705.

The Introduction and General Survey is devoted to a résumé of the law and regulations governing public motor services, with summaries of reports and announcements issued by Government Departments, Committees, and other official bodies, and brief comments on subjects of topical interest. The following are a few of the special subjects dealt with—

Statistical Summary reviewing the Progress of the Year—Railways Bill, 1921, Plying for Hire, Extraordinary Traffic, Restriction of Traffic on Specified Roads, Lights on Vehicles Committee, Road Direction Posts and Warning Signs, The Present Position of Power Alcohol. Roads Act, 1920—New Scale of Licence Duties. Ministry of Transport—Summaries of the Work of various Departmental Committees, Classification of Roads. Motor Tax Account, 1921—Number of Motor Vehicles Licensed in Great Britain, Total Amount of Duties Collected.

The four sections that follow deal with (1) motor transport undertakings from financial, commercial and descriptive aspects, the undertakings having a geographical index; (2) financial and commercial information of the manufacturing companies providing the vehicles and accessories required for these transport services; (3) the aims, objects and constitution of the associations and societies connected with the industry, and particulars relating to traffic bureaux, coach stations, and selected fuel, insurance and hire-purchase companies; and (4) names and addresses (numbering nearly 6,000) of the directors and officials engaged in transport services and motor manufacture.

The motor operating undertakings account for 1,888 of the total of 3,030, and comprise 1,280 joint stock and parliamentary companies, 508 private firms, and 100 municipalities, including those applying for powers in the present session of Parliament. How great is the advance in all forms of road transport is revealed by a comparison of these figures, with the records of previous volumes. The number of public motor vehicles in service, according to the definite figures supplied by 466 transport undertakings, is 11,586, the companies accounting for 10,937 of these and the municipalities for 649.

Driving Tests Proposed.—In their new Parliamentary Bill the Stoke-on-Trent Corporation seek power to impose tests on motor drivers. The Bill provides that no person shall be entitled to a driving licence until he shall have proved his ability to drive a motor vehicle.

OMNIBUS SERVICES.

Albury, N.S.W.—The Municipal Council are considering a proposal for a service of electric omnibuses similar to those which have proved successful in New Plymouth, New Zealand. The omnibuses would be worked by batteries charged from the high-tension lines of the municipal electricity undertaking at night when the load is off.

Belfast.—The Corporation are seeking powers to run omnibuses within a ten-mile radius of the city.

Birmingham.—The tramways department have ordered eight one-man omnibus bodies from John Buckingham, Limited, Birmingham, for mounting on Leyland chassis.

Bridlington.—The Watch Committee have determined to gran licences for omnibuses only to vehicles fitted with pneumatic tyres or super-cushion tyres. This decision was arrived at after hearing a deputation from the Commercial Motor Users' Association and a representative of the Daimler Company, Limited.

Burnley.—The Watch Committee have refused licences to the Ribble Motor Services, Limited, to ply for hire within the borough. The refusal is due to the congested state of the streets, and the fact that, in the Committee's opinion, the requirements of the public are sufficiently met.

Cardiff.—The Great Western Railway Company have asked Cardiff Tramways Committee to consider their views before taking active steps to provide omnibus services to Newport. The company state that they are improving the railway service between the two places and may apply for the right to run a road service if the Corporation does not operate one.

Chester-le-Street.— The Northern General Transport Company, Limited, have placed in service six Daimler saloon omnibuses, accommodating 20 passengers. The new vehicles are fitted with pneumatic tyres. The driver is completely enclosed, and the passengers enter by a door at his side. An emergency exit is provided at the rear.

Dundee.—The Tramways Committee have decided to seek powers to establish omnibus services in the city and neighbouring districts.

Edinburgh.—The latest double-deck 54-seat omnibus supplied by the Associated Equipment Company to the Edinburgh Corporation Tramways Department has a weather screen which fills the space between the engine and the canopy. Protection is given at the sides by means of flaps attached to the screen.

Hull.—The Tramways Committee have resolved that three Bristol Tramways and Carriage Company's chassis at £892 each, and three English Electric Company's bodies at £435 each, be purchased for the omnibus service.

London.—From January 1 next the minimum fare on the L.G.O.C. omnibuses and other vehicles of the London Underground Group will be 1d. per mile. The 1½d. fare will be reduced to 1d., and other fares will be correspondingly adjusted. On the omnibus routes alone the reductions will necessitate the revision of 12,000 separate fares.

Manchester.—The Corporation Licensing Committee have refused an application by the British Automobile Traction Company, Limited, for permission to run omnibuses on certain routes in South Manchester.

Newcastle-on-Tyne.—Ryton Urban Council suggested to Newcastle Corporation that their omnibuses passing through the district should be fitted with pneumatic tyres and should be smaller and lighter, in order to lessen wear to roads and the vibration to houses. A reply has been made to the effect that, if the roads were kept in better condition much of the cause for complaint would be removed. Pneumatic tyres had been tried without success, and the further expenditure could not be incurred, unless Ryton would give Newcastle a monopoly in transit facilities.

Plymouth.—The Tramways Committee have decided to seek power to inaugurate omnibus services to Tavistock, Yealmpton, Compton, etc.

Rotherham.—In order to reduce the cost of operation the Corporation tramways department propose to convert a petrol omnibus and a trolley omnibus to front entrance working.

Sydney, N.S.W.—There is a proposal for the establishment in this town of a traffic board, which is required more especially to deal with motor omnibus traffic.

Walsall.—The Corporation propose to seek sanction for a loan of £2,500 for the cost of an omnibus garage.

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MOTOR TRAFFIC

THE VULCAN SIX-WHEELER.

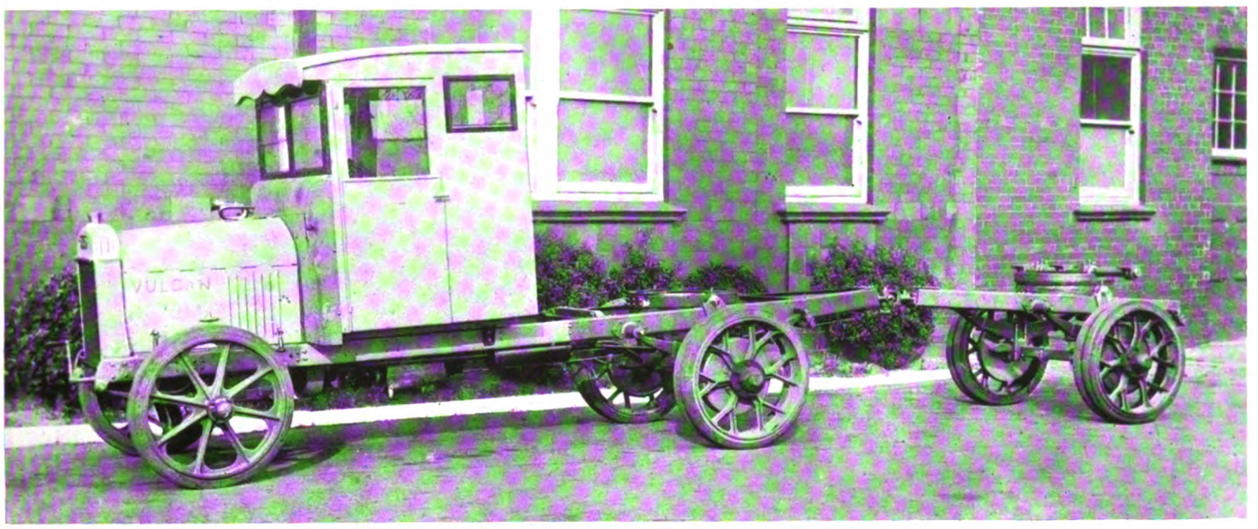
Although there are a number of reliable six-wheel vehicles designed for heavy loads up to the maximum permitted, credit must be given to the Vulcan Motor and Engineering Company for introducing a vehicle of this type adapted to carry moderate loads at low running costs. The new Vulcan six-wheeler here illustrated embraces special features that enable it to be used with practically the same freedom as a four-wheel lorry, and, although it is capable of taking a full 4-ton paying load, the running cost approximates to that of a lorry of half the capacity.

As will be seen from the illustrations the vehicle takes the form of a tractor and a semi or two-wheeled trailer. The chassis of the tractor is practically the Vulcan standard two-ton model, the only important difference being in the gear ratios. These have been reduced to the following—Top 7·25 to 1, third 11·3 to 1, second 18·7 to 1, first 48 to 1, and the reverse 58 to 1, while the reduction ratio of the overhead worm drive is 8·3 to 1.

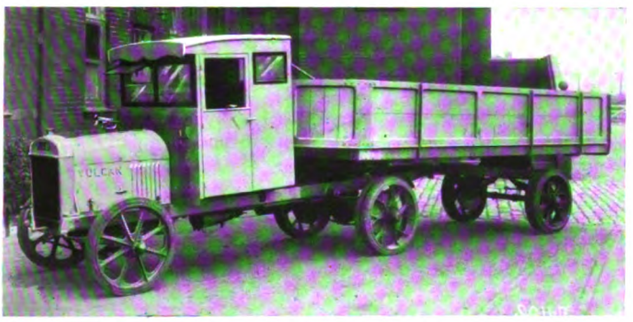
The 4-ton carrier body is mounted upon two turntables, one placed immediately above the rear axle of its tractor and the other above the axle of the trailer. Each of these act upon a king pin, which, however, serves only to determine the position of the carrier body and to take up the minor stresses of stopping and starting. The turntables are of a patented design and so arranged that it is impossible to distort the body whatever the position of the chassis. Moreover, the steering of the vehicle is unaffected by any movement of the chassis. The frame of the tractor as well as the trailer have each triangular extensions built in to the main frame; these are coupled together by means of a universal joint which takes all the tractive stresses. This universal joint, of which a drawing is given above, is placed directly in the centre of the space between the rear wheels of the tractor and those of the trailer, thus ensuring the accurate tracking of these wheels and enabling the vehicles to be handled with perfect freedom. Compensating movements in each of the turntables are arranged to provide for all road conditions and turning movements.

Special attention has been devoted to the provision of efficient brakes. All four rear wheels are fitted with brake drums of large diameter, upon which an internal expanding brake, hand operated, acts. There is also the external brake operating upon a drum mounted on the cardan shaft immediately behind the gear box. This is operated by a foot pedal and is a standard fitting of all Vulcan chassis. The brakes are applied to the wheels of the trailer by means of two operating shafts, the inner ends of which are supported by brackets mounted on the axle and fitted with levers, the brake operating cable being attached to the centre of a compensating lever mounted between them. The steel operating cable is supported by a fitting attached to the centre of the universal coupling, so that application of the brakes to the trailer can be effectively made under all conditions. The dimensions of the standard carrier body are 16 ft. 9 in. by 5 ft. 7¾ in. inside measurement, the front end being curved to permit of turning. The overall length is 25 ft. 3 in., with a wheel base between each pair of wheels of 10 ft. The unladen weight of the complete vehicle is 3 tons 11 cwts. 2 qrs., the registered axle weights being—Front, 1 ton 18 cwts. 3 qrs.; rear (combined), 5 tons 12 cwts. 3 qrs. The total laden weight is 7 tons 10 cwts. 6 qrs.

Universal Joint Uniting Tractor and Trailer.



Vulcan Tractor and Two-Wheeled Trailer, Forming Six-Wheeled Vehicle.



Vulcan Six-Wheeled Vehicle.

THE "F.S." PETROL-ELECTRIC OMNIBUS.—In order to avoid any misapprehension, Mr. Percy Frost Smith desires it to be known that the "F.S." omnibuses now running in London have been constructed entirely from his own design, including chassis and equipment, and are in no way associated with any other firm manufacturing petrol-electric vehicles. All inquiries respecting these omnibuses should be addressed to Mr. Percy Frost Smith, 64 Victoria Street, Westminster, S.W.

SHEFFIELD CORPORATION GARAGE.—The Ministry of Health have held an official inquiry into the proposal of the Sheffield Corporation to erect a central garage at an estimated cost of £30,000.

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MOTOR TRAFFIC

MOTOR TRAFFIC NOTES.

BAN ON TOP COVERS FOR OMNIBUSES.—Replying to an inquiry from the "National Workmen's Council," the Commissioner of Police for the Metropolis has stated that the licensing authority is not prepared to accept the responsibility of licensing omnibuses with covers over the top decks.

TRAFFIC LEGISLATION FOR NOTTINGHAM.—In the ensuing session the Corporation will apply for powers to authorise them to make orders as to routes to be observed by vehicular traffic in certain parts of the city, and to require that vehicles in certain streets shall pass in one direction only.

LONG DISTANCE PARCELS TRANSPORT.—In 1921 the Nottingham Chamber of Commerce instituted a clearing house scheme for motor loads. One branch of work taken up comprised the conveyance of parcels to London. This service has proved so successful that arrangements have been made whereby delivery will be effected ninety minutes earlier. A similar service is to be run to Birmingham.

OMNIBUS INCREASE IN THE UNITED STATES.—Automobile registrations in the United States show that the past year has seen more than a 25 per cent. increase in the omnibus figures. The total automobile registration at the present time amounts to 10,863,744, an increase of 1,428,775, or 15 per cent. over July 1, 1921, and 415,744 over the registration which was reported on January 1 of this year.

wait in lines or queues, and to empower them to erect and maintain barriers and posts for the regulation of such lines or queues. Another clause proposes the making of bye-laws as to hackney carriages (and particularly as to motor hackney carriages), and the drivers thereof, with regard to inspection, user, fares, licensing, identification and other matters.

MOTOR VEHICLES FOR MUNICIPALITIES.

SHEFFIELD CORPORATION propose to purchase three Leyland chassis at £875 each.

FELIXSTOWE URBAN DISTRICT COUNCIL are considering the purchase of a motor fire engine.

HORNSEY BOROUGH COUNCIL propose to purchase three 2½-ton electric vehicles for house refuse collection, at a total cost of £4,755.

NEWCASTLE CITY COUNCIL have obtained permission to raise a loan of £10,500 for the purchase of more mechanically-propelled vehicles.

ROTHERHAM TRAMWAYS COMMITTEE have recommended the purchase of a 25-cwt. Guy chassis from Guy Motors, Limited, at £430, and of an ambulance body from Fleetwood Motors, Limited, at £250.

LEEDS TRAMWAYS COMMITTEE propose to purchase three motor cars for use by committees and for departmental work, at a cost of £1,000 each. Leeds Gas Committe have authorised the purchase of two motor vans at a total cost not exceeding £960.

Fleet of Leyland Single-Deckers, R.A.F. Reconditioned Type, for Autobus de Cordoba, Spain.

CROYDON AND NOISY TRIPPERS.—The Corporation have asked the Ministry of Health to sanction a bye-law making it an offence for passengers on a public or hired vehicle to make any noise to the annoyance or interruption of residents, or to throw money to be scrambled for. Conductors or owners of vehicles are to be liable to a penalty unless it is proved that they were unable to prevent the offence.

SMALLER DIAMETER TYRES IN THE U.S.A.—A new omnibus tyre, 4 inches smaller in diameter than the standard type, is making headway in the United States. The object of the decrease in diameter is to bring the omnibus body closer to the ground to prevent swaying and danger from turning over. More than 75 per cent. of the accidents reported on street cars and omnibuses result from steps being too high.

UNSERVICEABLE TAXI-CABS IN LONDON.—With regard to unserviceable taxi-cabs, the General Purposes Committee reported to the London County Council that the licensing of taxi-cabs in London rested with the Metropolitan police and the Committee had no information regarding the number of unserviceable cabs. It appeared that the proper course to be adopted was for persons hiring such vehicles to make any complaints direct to the police.

CHATHAM CORPORATION BILL.—The Bill to be promoted next session by Chatham Corporation asks for power to make bye-laws for requiring persons intending to enter tramcars or omnibuses to

HOVE CORPORATION WORKS COMMITTEE have recommended the purchase of two electric wagons for refuse collection from Electricars, Limited, at a total cost of £2,708. They propose also to purchase a petrol tipping wagon of a make to be decided later, at an estimated cost of £750.

THE METROPOLITAN ASYLUMS BOARD have accepted the following tenders for the period ending March 31, 1923—G. Spencer Moulton and Company, Limited, pneumatic tyre covers and inner tubes; North British Rubber Company, Limited, pneumatic tyre covers and inner tubes; and Charles Macintosh and Company, Limited, solid tyres.

SOUTHPORT CORPORATION effect the collection of house refuse by both motor and horse haulage. The actual collection is made by a specially devised horse-drawn container or wagon. When full the container is placed on a Pagefield lorry for conveyance to the tip. This system is the invention of Walker Brothers, Limited, of Wigan, manufacturers of Pagefield commercial vehicles.

LONDON COUNTY COUNCIL have accepted the tender of Dennis Brothers, Limited, for three fire engines at £4,365, less an allowance of £1,200 for old engines in part payment, and the tender of Leyland Motors, Limited, for four engines at £6,168, less an allowance of £1,300 for old engines in part payment. The total amount of the contracts is thus £8,033, after deducting allowances for the old engines.

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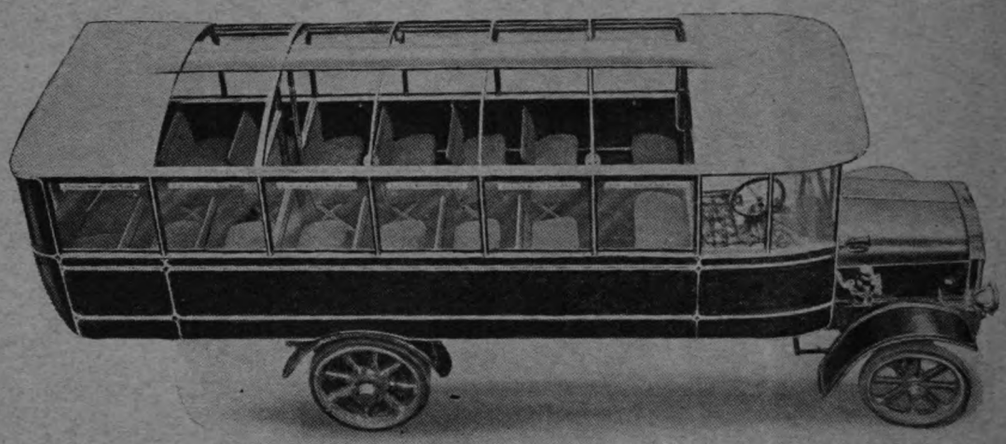

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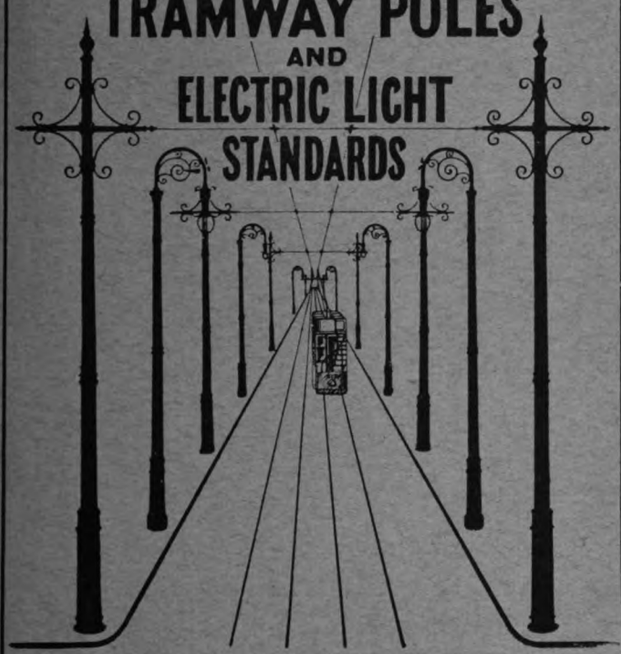

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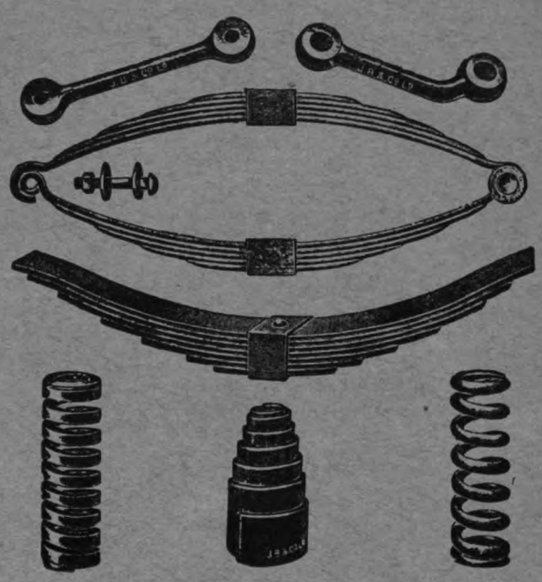

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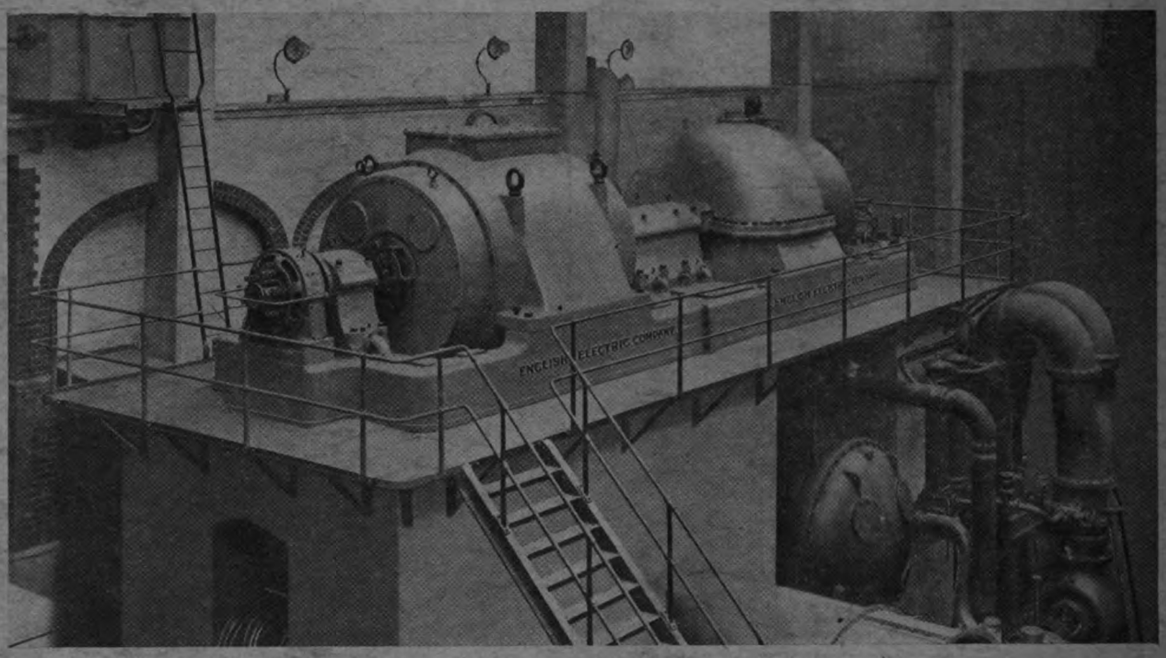

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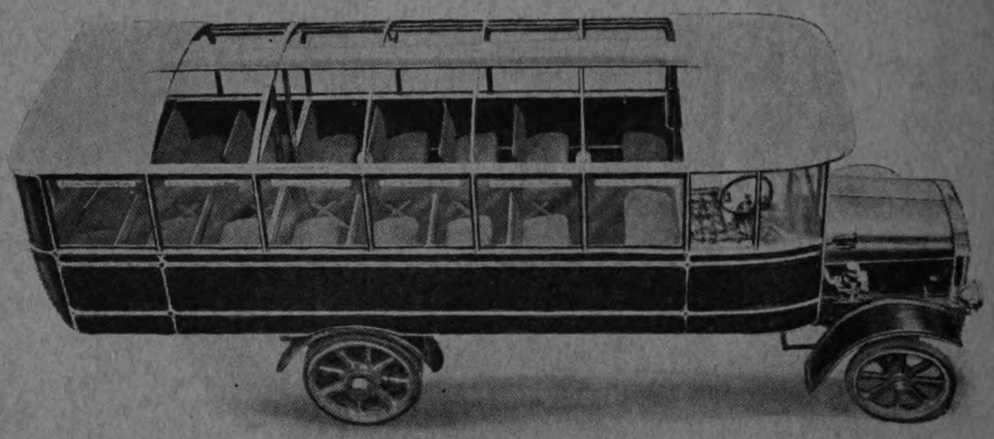

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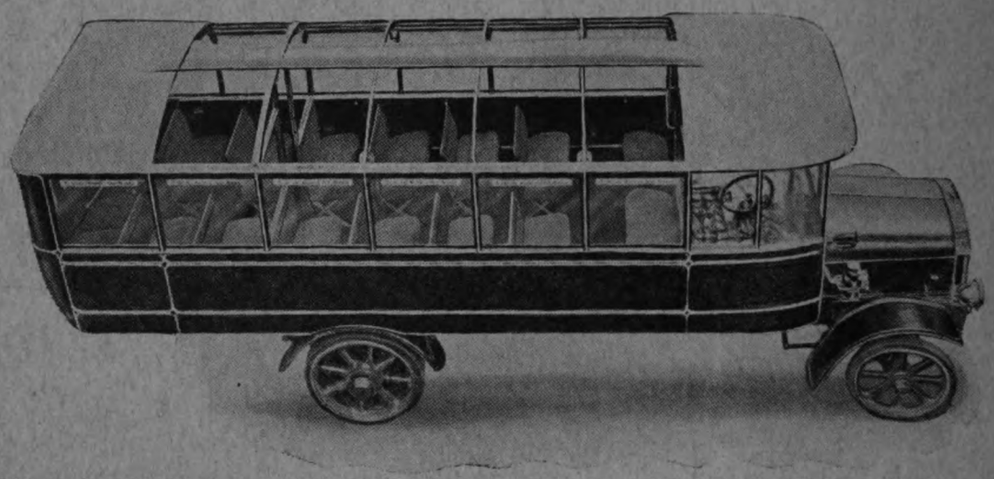

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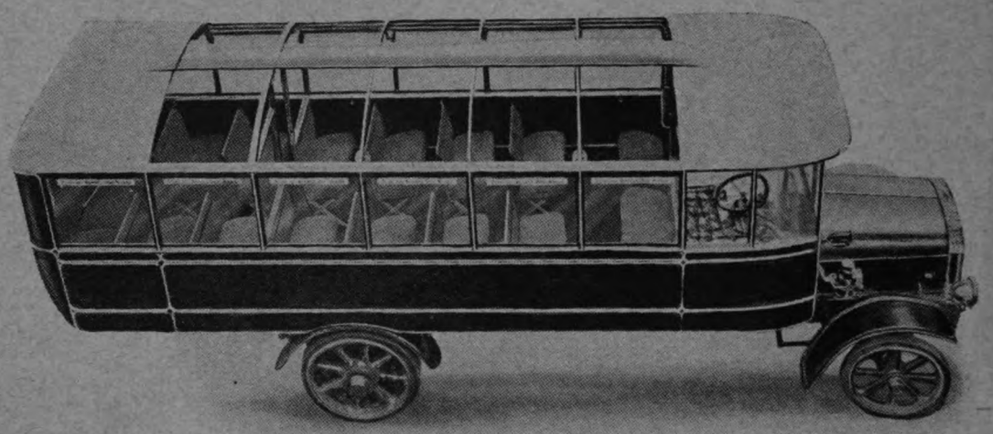

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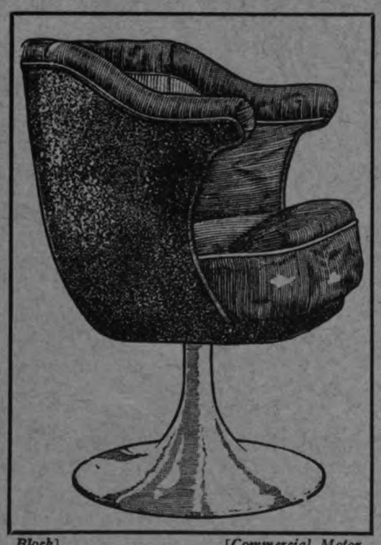

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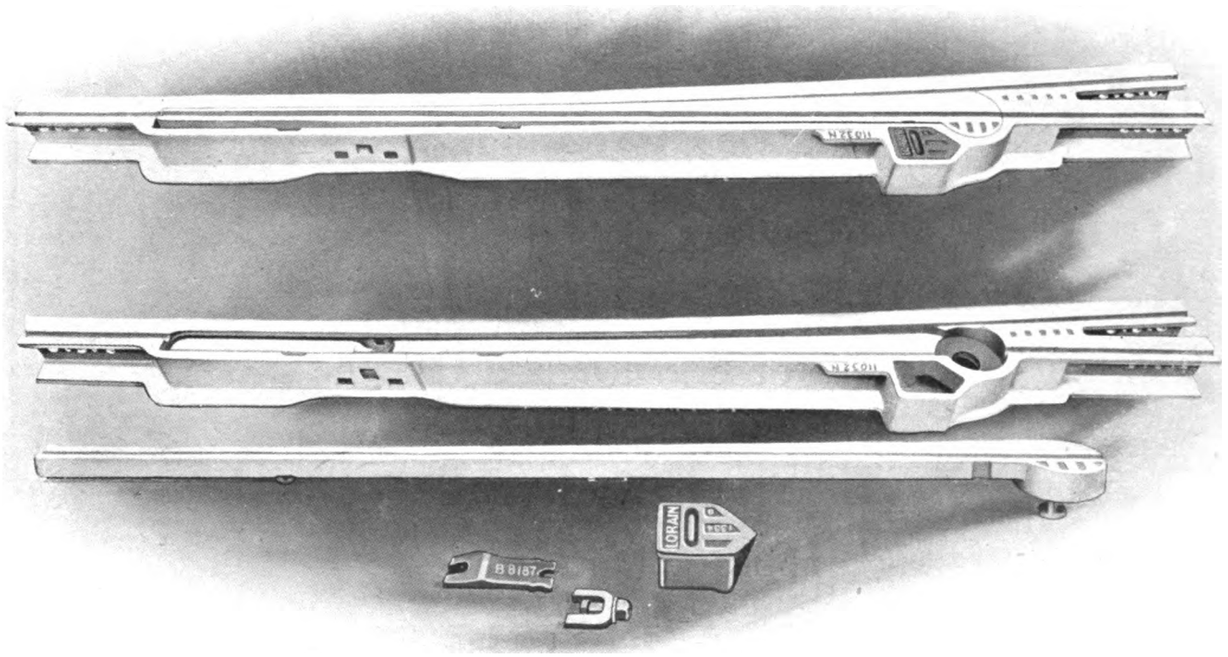

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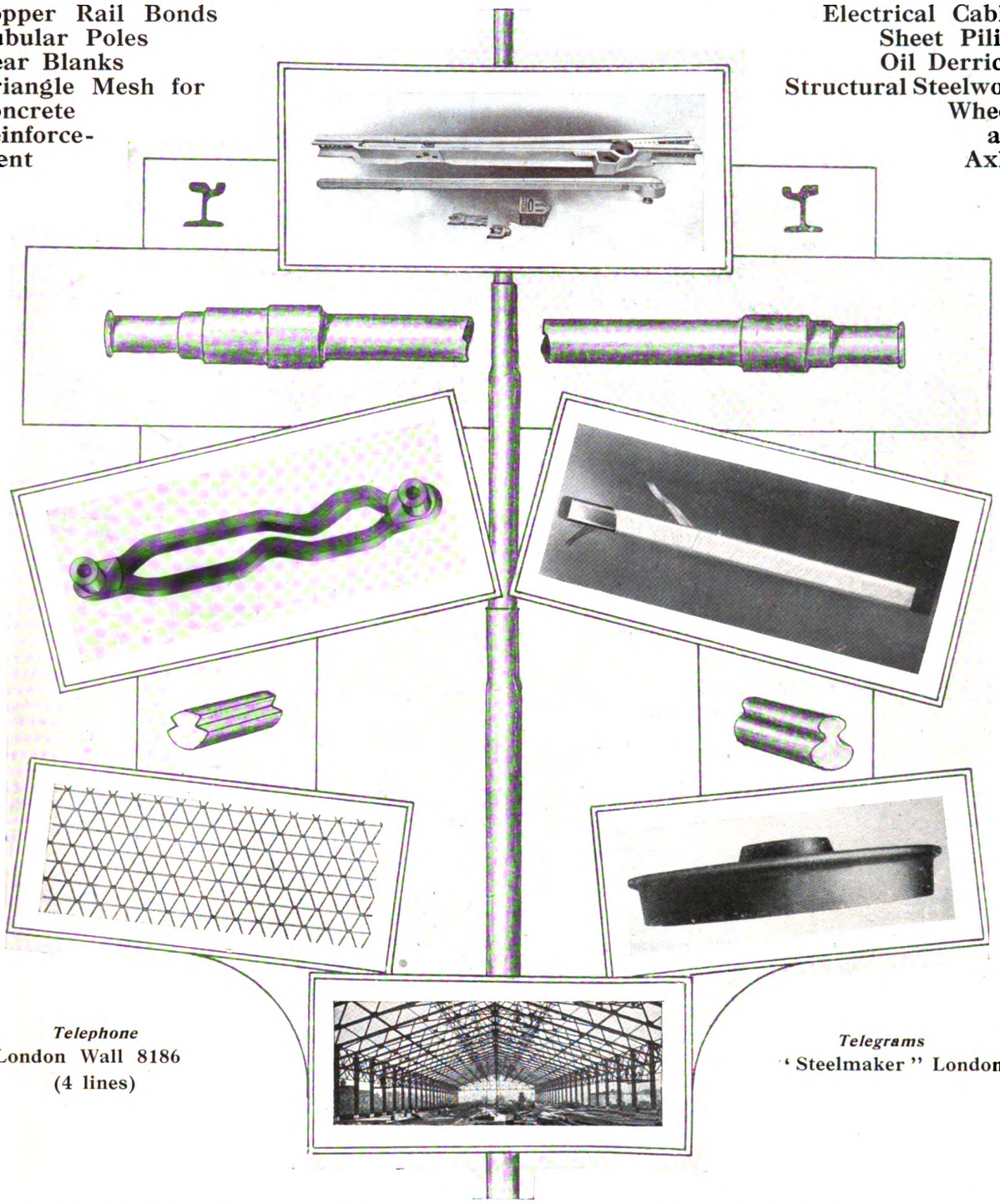

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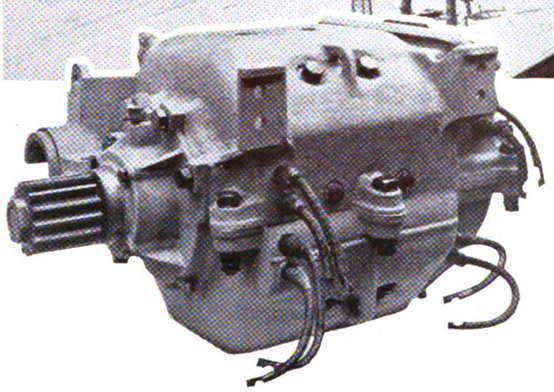

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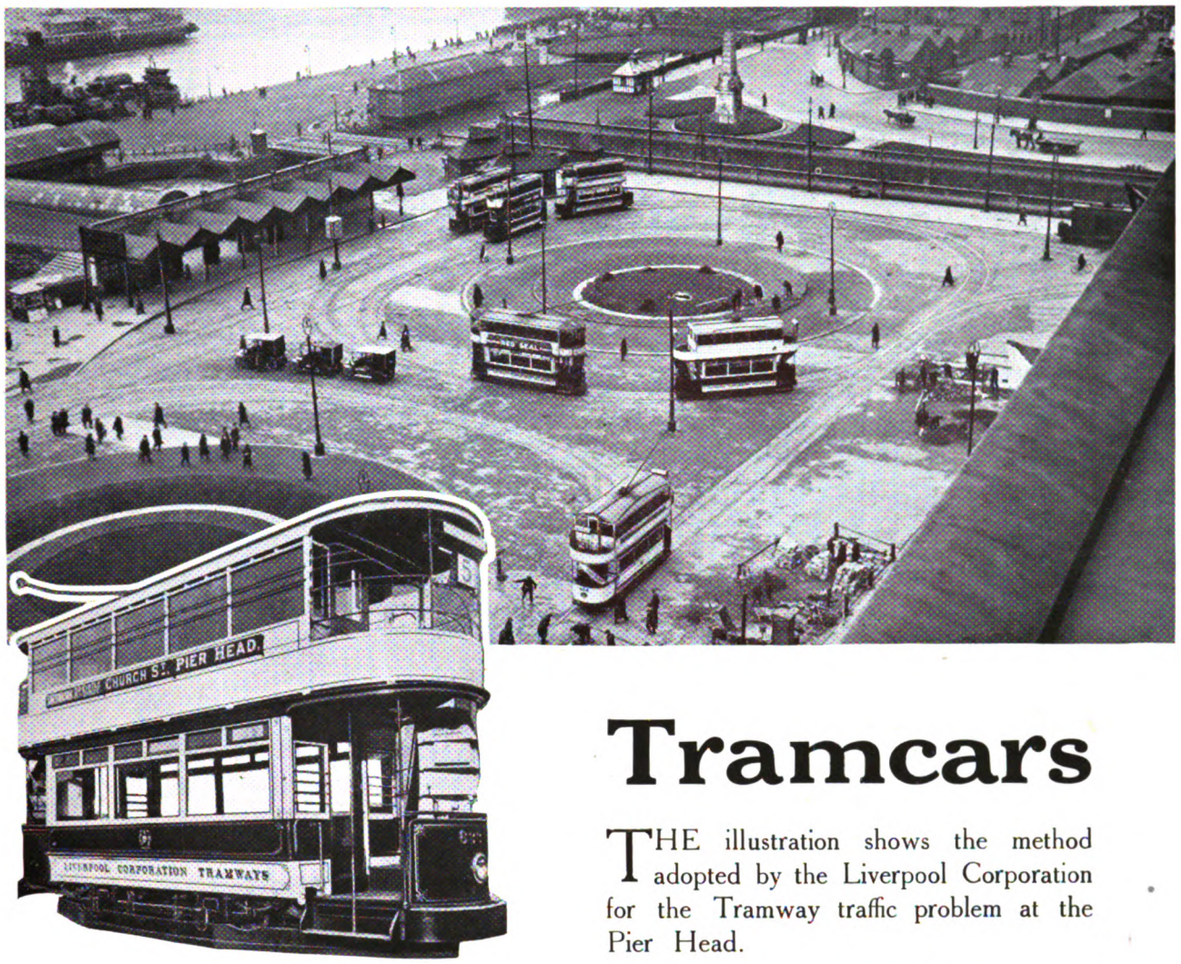

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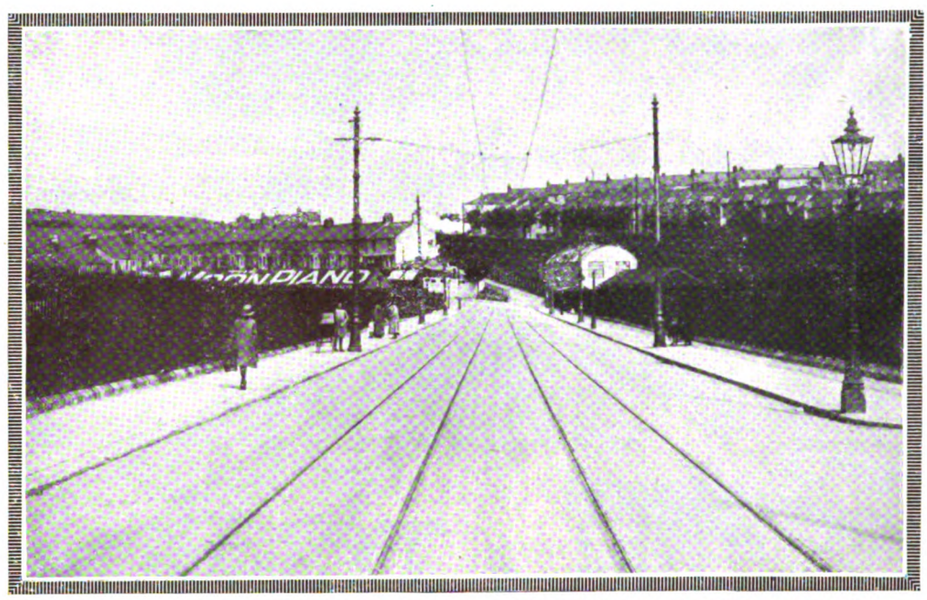

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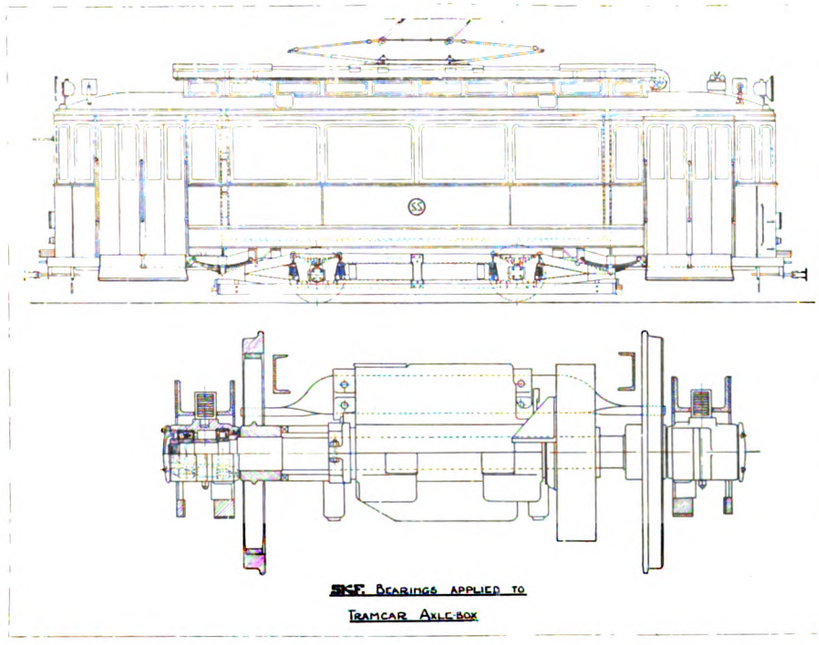

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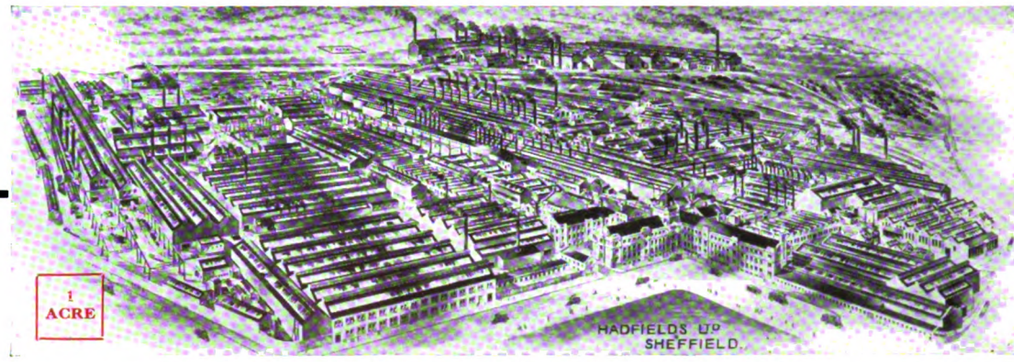

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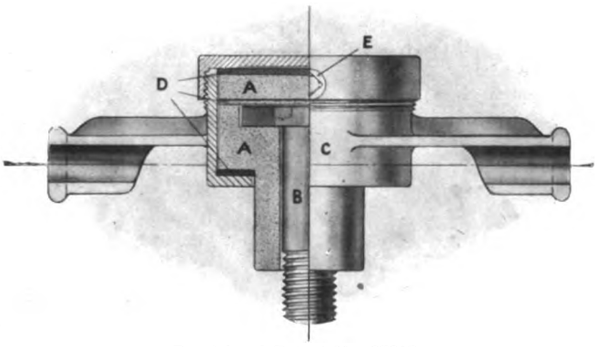

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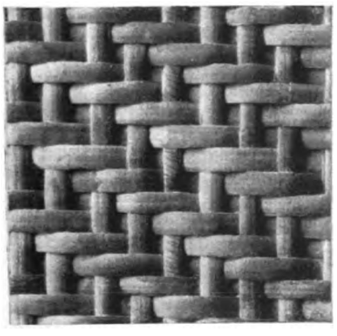

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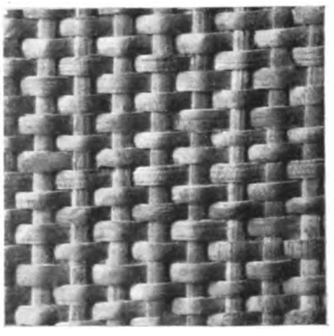

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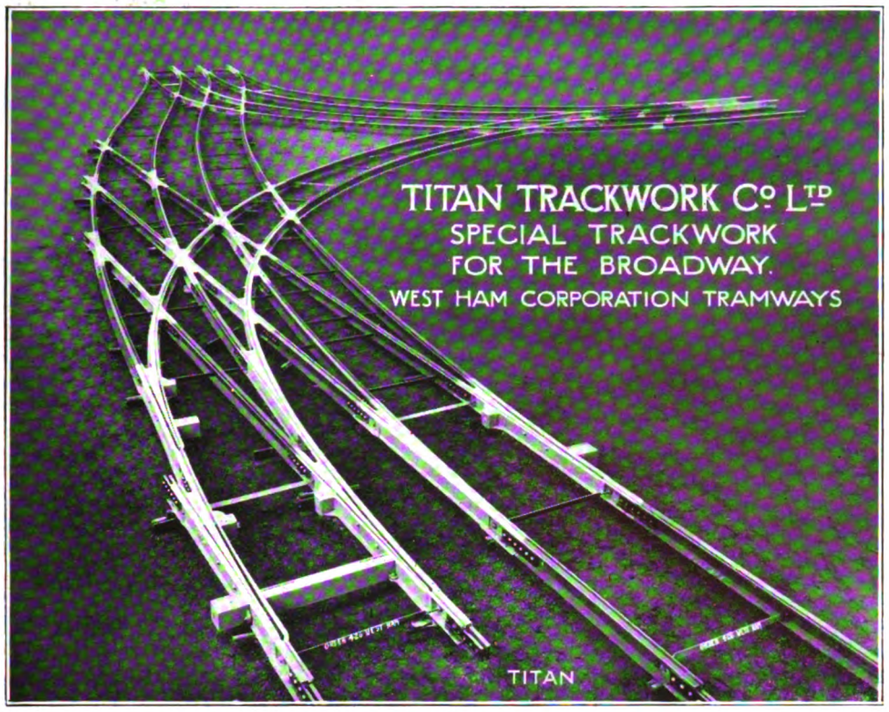

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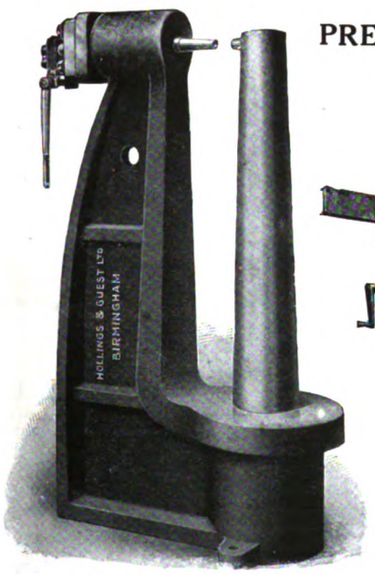

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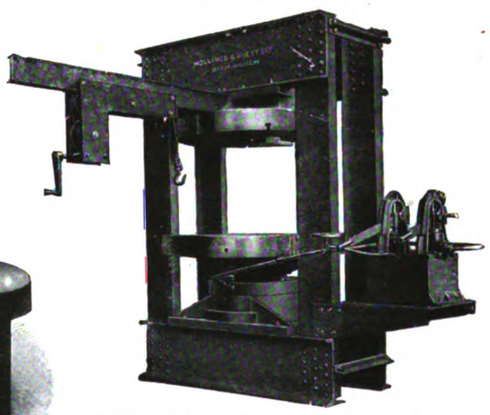

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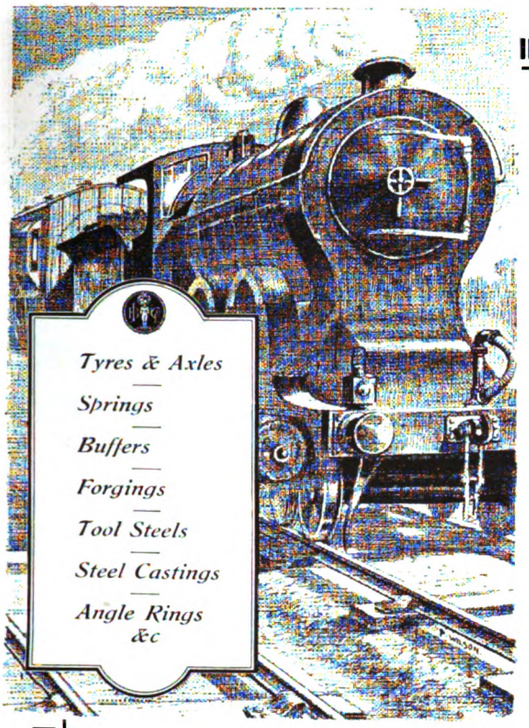

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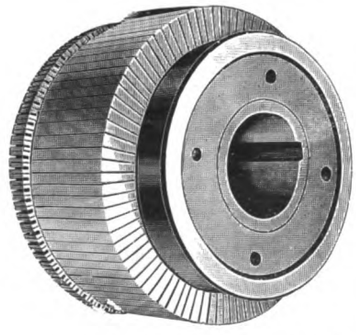

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(Continued on page xx.)

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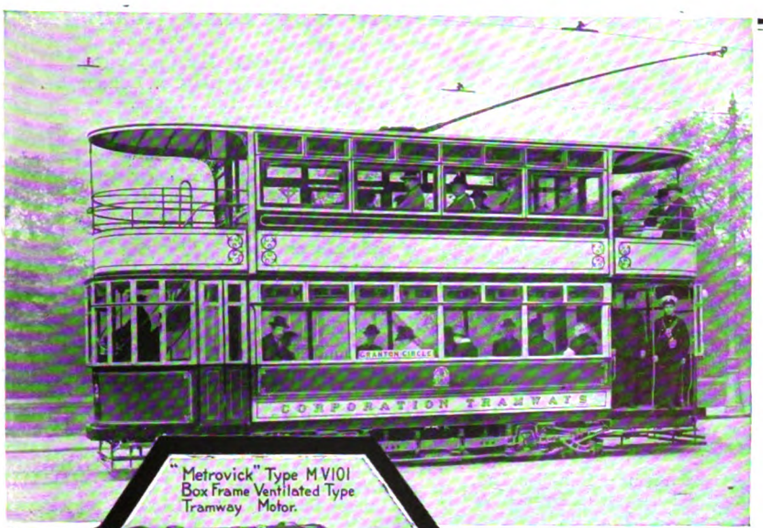

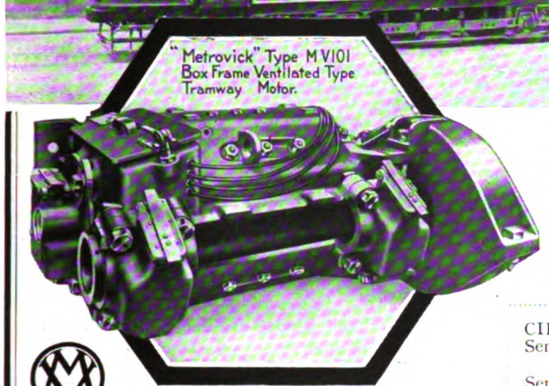

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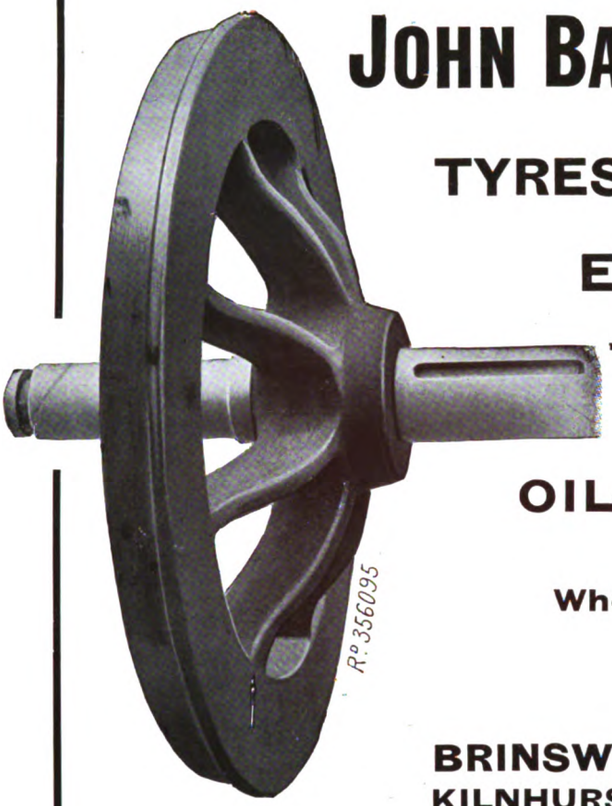

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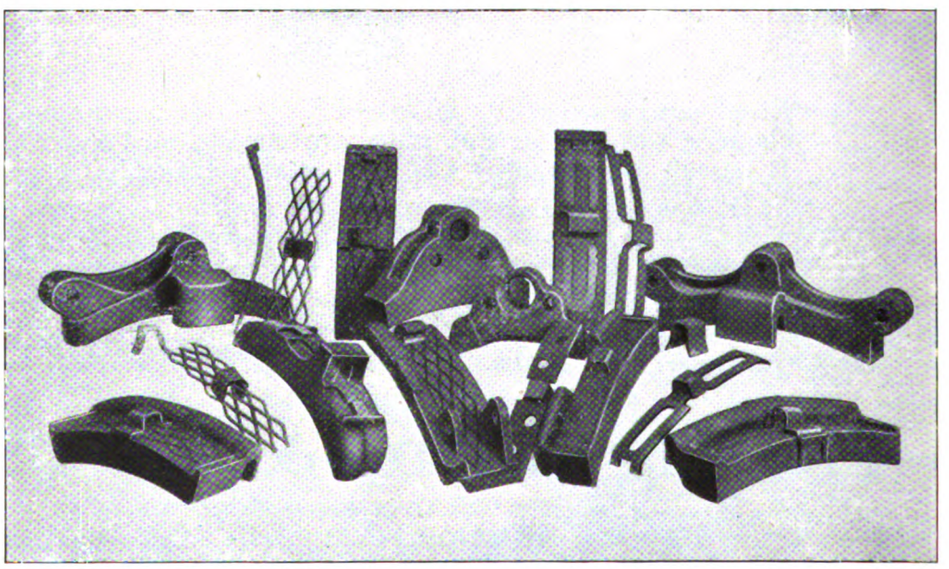

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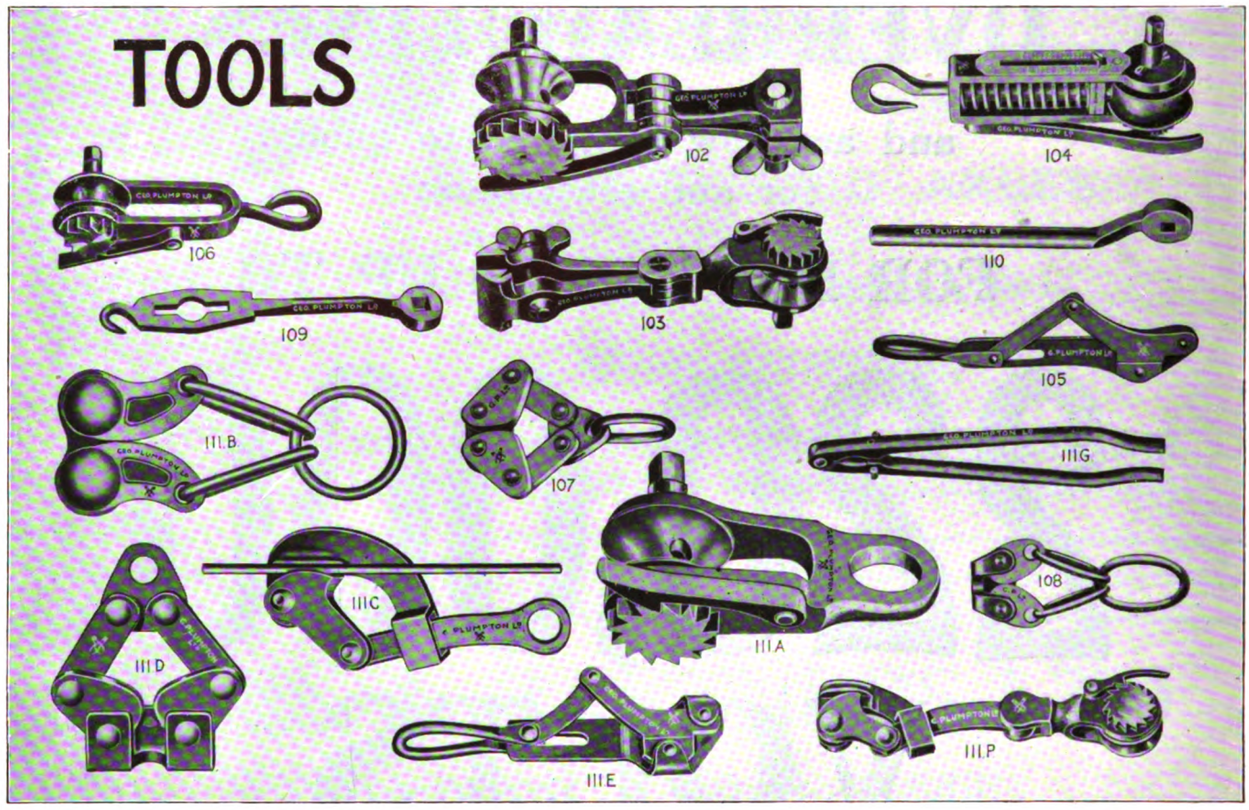

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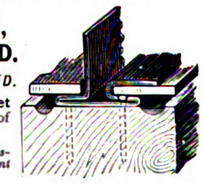

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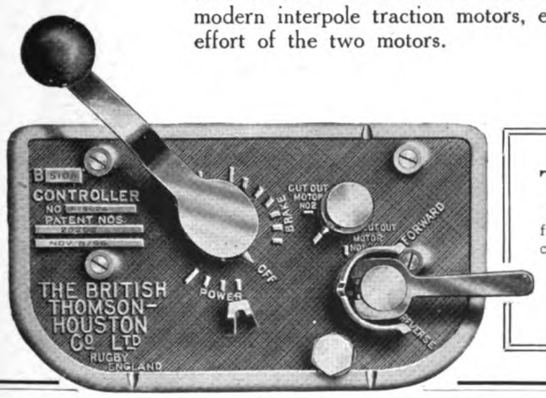
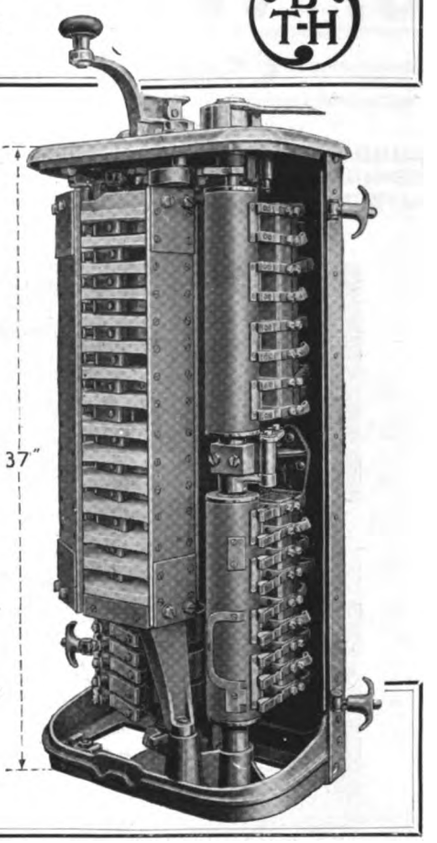


THE illustrations show the new B.T.H. (B.510) Tramcar Controller with the front cover removed, and the cap-plate with main control handle, the reversing lever and the indicating motor cut-out spindle.



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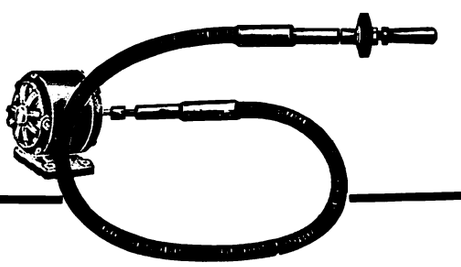

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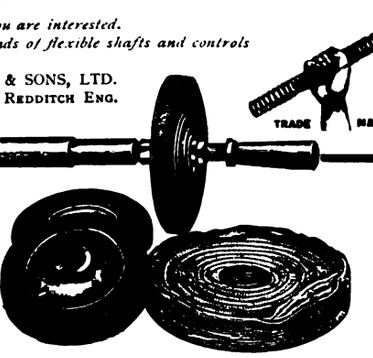

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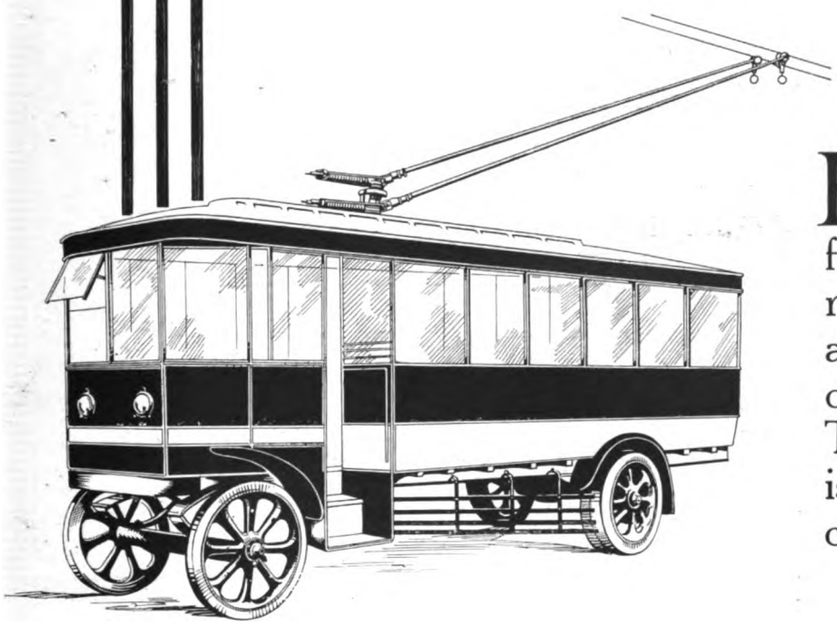

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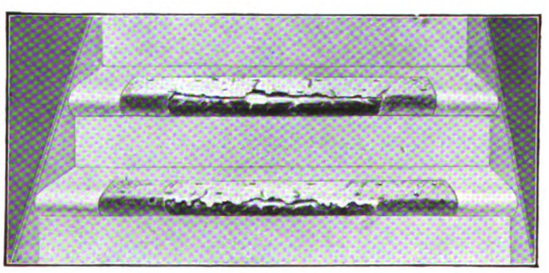

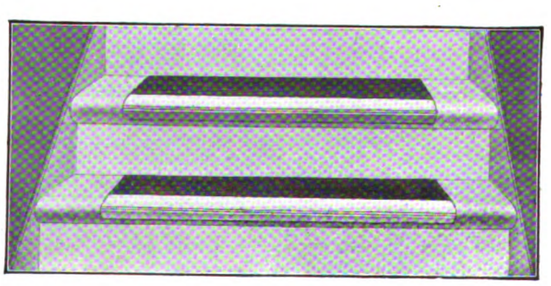

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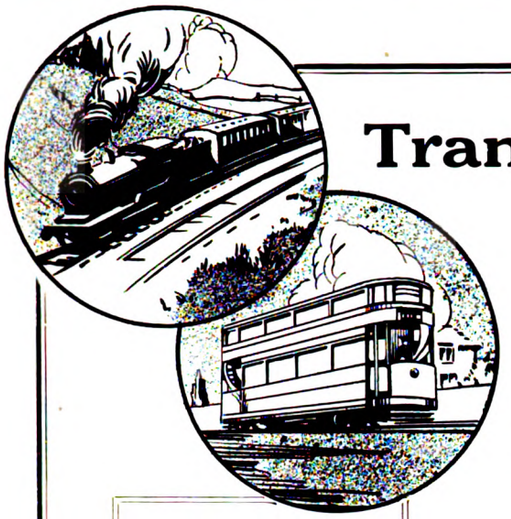

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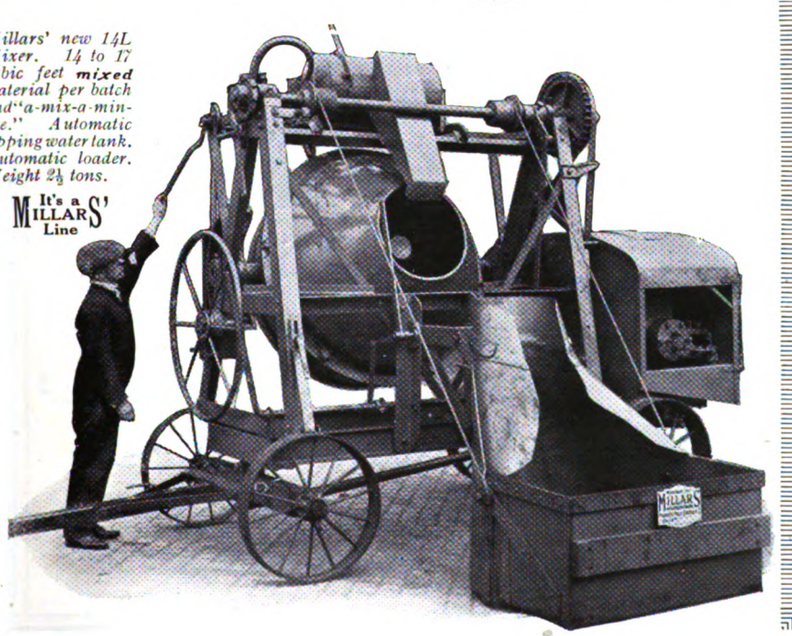
This new mixer is beating them all



Millars' new 14L Mixer. 14 to 17 cubic feet ***mixed*** *material per batch and "a-mix-a-minute." Automatic tipping water tank. Automatic loader. Weight 2½ tons.*

It's a MILLARS' Line

INTRODUCED to meet the need for something not too big and not too small in the mixer line, this new MILLARS' 14L is already making friends.

¶ 14 to 17 cubic feet of **mixed** material per batch, and capable of "a-mix-a-minute," it offers you a thorough mix at much lower than your present costs.

Your profits are concerned—so ask for full particulars.

Machinery Dept

MILLARS' TIMBER & TRADING CO. Ltd

Pinners' Hall, Gt. Winchester St.

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'Phone London Wall 368 *'Grams* "Jarrah Stock London."

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RELIABLE DURABLE ECONOMICAL UNBREAKABLE

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Also Makers of
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Main Steam Pipe Installations

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SECTION OF STEPPED TYPE POLE.

POLES
of any design or description for
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British Mannesmann STEPPED TYPE POLES a speciality

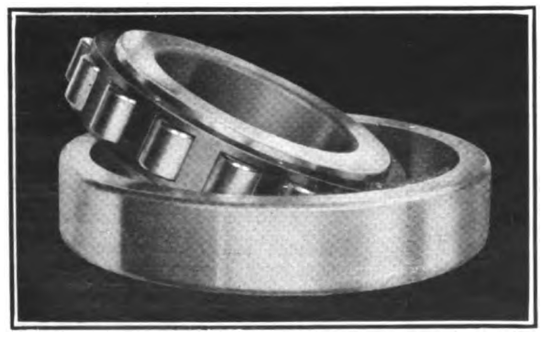
Supplied in one complete length without weld or joint, for light, medium or heavy loads

KAY TOWERS for Overhead Transmission Lines

THE BRITISH MANNESMANN TUBE Co. LTD.

Works—Landore S. Wales 67 QUEEN VICTORIA ST. LONDON E C 4 and Newport Mon.

Think of Friction *not only in terms of* Wasted Power *but also in terms of* WEAR ! ! !



EVERY time a Car goes into the repair shop it means EXPENSE. To keep it out means SAVING. Cars fitted with

HOFFMANN ROLLER BEARINGS

to both axles and motors very seldom need the services of the repair gang. They are ALWAYS SAVING MONEY!

THE HOFFMANN MFG. CO. LTD
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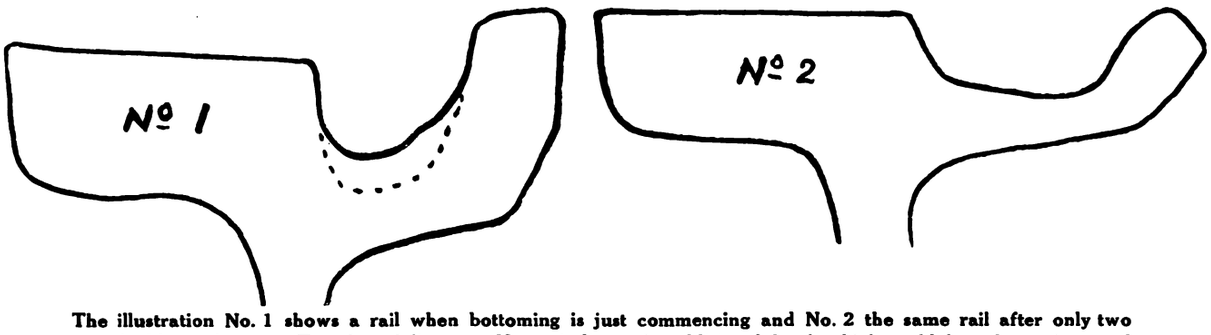
The Woods Gilbert System of Rail Remodelling will postpone that problem of Reconstruction for many years



The illustration No. 1 shows a rail when bottoming is just commencing and No. 2 the same rail after only two years' additional wear. The dotted lines on No. 1 indicate the additional depth which could have been given and has been given on similar rails by the adoption of this process, thus preventing the spreading of the lip as shown on No. 2 and adding five or six years' additional wear.

The Company is now in a position to negotiate for further Contracts in Great Britain and France to be started at an early date. Enquiries solicited.

THE WOODS GILBERT RAIL REMODELLING CO. LTD.

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GUARANTEED GEARS & PINIONS

TOOL Steel Gears are not a new idea

Years of practical test prove beyond all doubt that Tool Steel Gears and Pinions outlast any other material on the market.

We are prepared to give a guarantee, that wherever our Tool Steel Gears and Pinions are introduced, a very considerable saving will be effected. Longer life in Gears means a lowering in repair costs—a fact that should not be overlooked.

Correspondence on this subject is invited

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Chilled Iron & Steel Co. Ltd.

Temple House, Tallis Street, EC4

Steel-Tyred Wheels

fitted with special toughened and annealed Semi-steel Centres.

Principal Advantages Claimed for these Centres

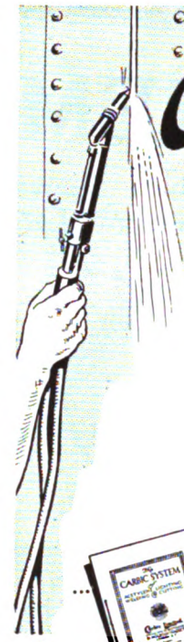
1 They will withstand a higher compression than any other Centre on the Market.

2 No Set-screws or Retaining Rings are required.

3 The Centres retain their original shape so that re-tyring is made comparatively easy.

4 No difficulty is experienced in expanding the worn-out tyre from the centre.

Works—**BARROW-IN-FURNESS**



Cutting 3/4" Boiler Plate

at 10 inches per minute with the CARBIC PORTABLE PLANT

VISUALISE the advantages of having such guaranteed capacity available for your cutting work *anywhere in your shops or yards*—not merely confined to one particular location.

Compact generator design and the use of CARBIC CAKE, which generates *pure* acetylene at a constant pressure, together make this possible. THE CARBIC Portable Cutting Plant is essentially the multum-in-parvo Plant. Investigate its possibilities on your work.

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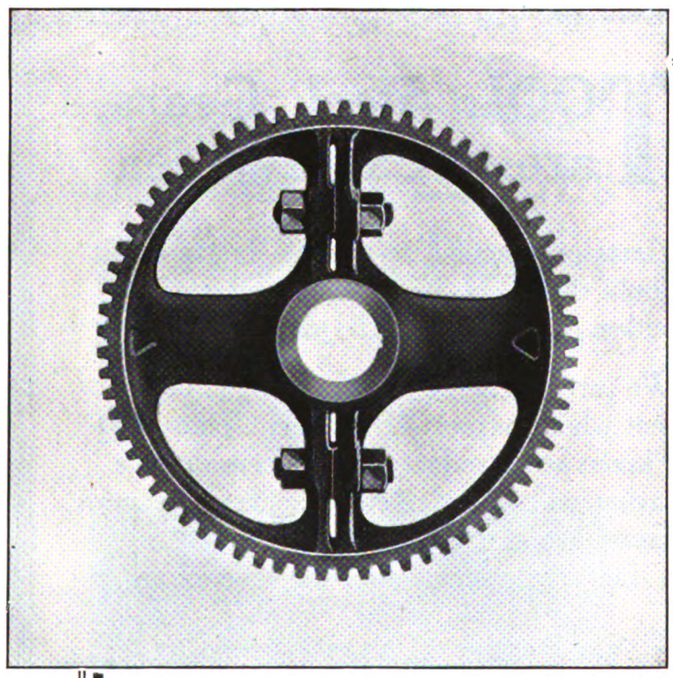
The Secret lies in Carbic Cake

***Branches*—Liverpool, Newcastle-on-Tyne, Glasgow, Leeds, Cardiff & Southampton**



STEEL CASTINGS FOR ALL PURPOSES

Gear Wheels

for

Tramway Engineering

SPLIT or SOLID

HARDENED GEARS

a speciality

NATIONAL STEEL FOUNDRY (1914) LTD

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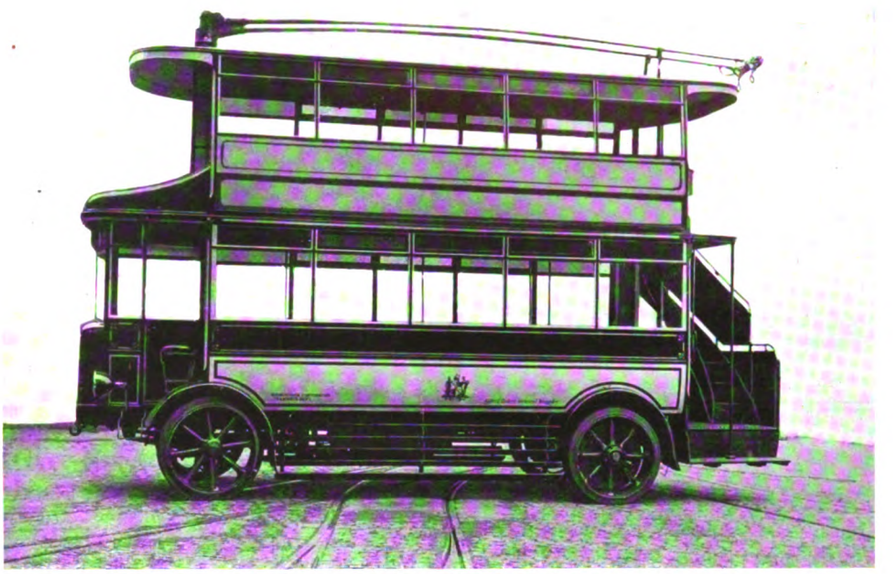
ON
RUBBER TYRES



THE "RAILLESS" PATENT CAM-CONTROLLED TROLLEY IS THE ONLY TROLLEY THAT ENABLES A VEHICLE TO DEVIATE AT ANY SPEED AND TO ANY EXTENT.

OUR TROLLEY STAYS ON THE WIRES AND DOES NOT NEED NURSING.

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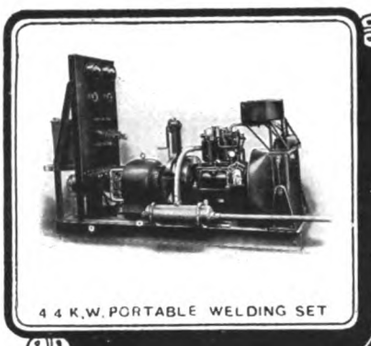
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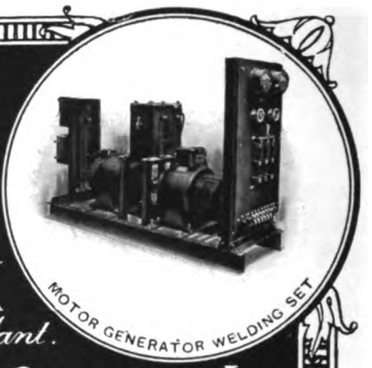
THE "PREMIER"
4·4 K.W. PATENTED
WELDING GENERATOR
supplies the correct current for any given job and offers many other ADVANTAGES
Gives perfect results for both light and heavy work.—Owing to small size and light weight is admirably suited for portable and mobile welding plant.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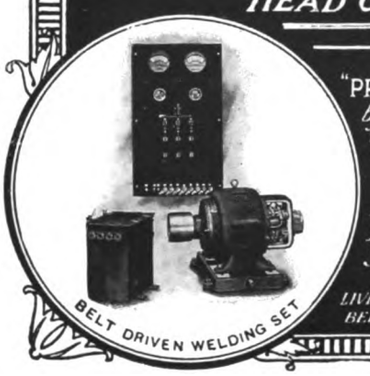
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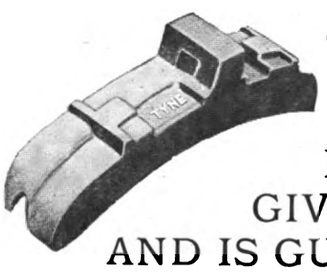
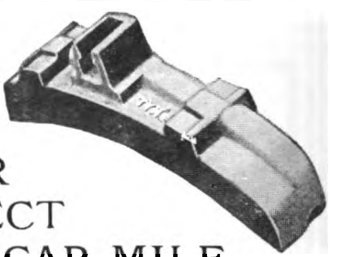
FOR BRAKE SHOES SPECIFY



"TYNE METAL"



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GIVES GOOD BRAKING EFFECT
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Telegrams "TICKETS, GLASGOW"

If you ask that question of the managers of the largest tramway undertakings, both at home and abroad, the answer will be—
"Yes, we use Glasgow Tickets."

May we send you some specimens? We produce tickets in any style, in any quantity, and print in any language.

Whenever you want tickets, either paper or pulp, we shall be pleased to quote you.

Freedom from ticket worry will be assured if you send your orders to

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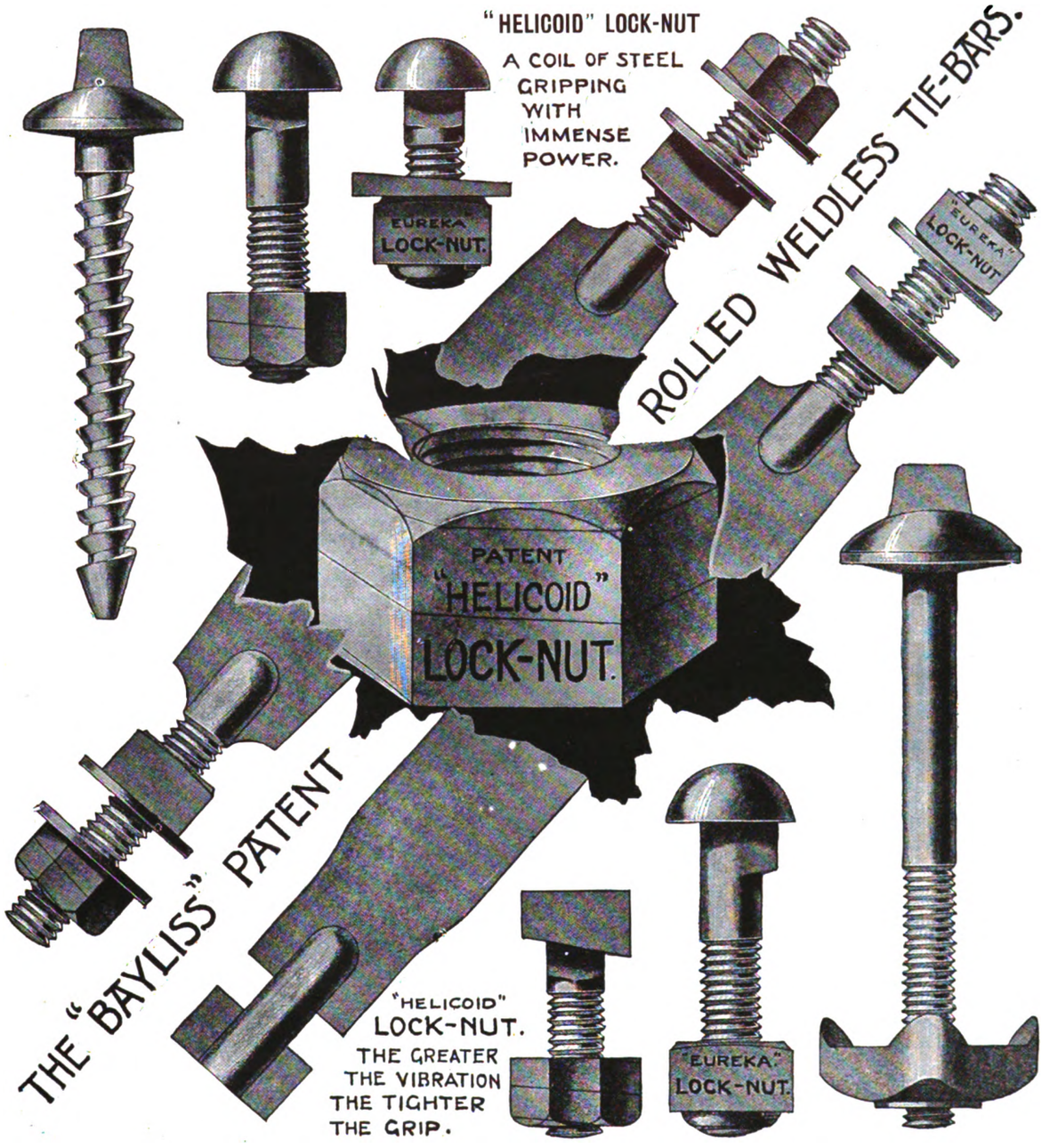

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Telephone Service is peculiar—BLUE BELLS are peculiarly fitted for it.

YOU would pick a thoroughbred for the running race—a horse that is built and trained for the race. You would follow the universal judgment of other racing men the world over.

There are more thoroughbreds used in horse racing than heavy draught horses.

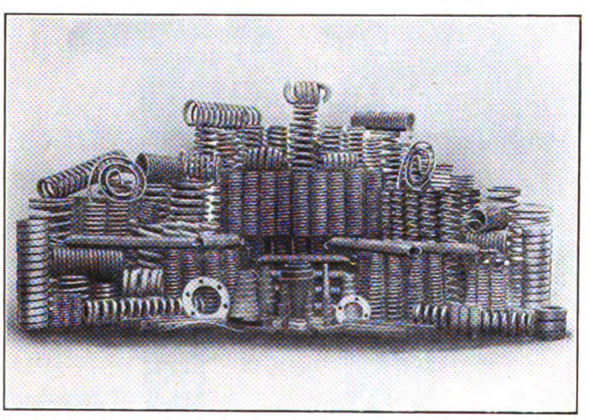
As in selecting race horses, why not select for telephone service a battery designed and built for that work? By doing so, you will follow the example of the majority of telephone companies.

There are more Blue Bells used for Telephone Service than General Utility Batteries.

Western Electric

BLUE BELL BATTERIES

are the thoroughbreds to pick for telephone service. **Medium Amperage** and **Low Shelf Wear Rate** combine to give the **BLUE BELL** a long and useful life that cannot be obtained with commercial general utility batteries.



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Engineers and Spring Makers

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SPECIAL FEATURES—
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Satisfaction

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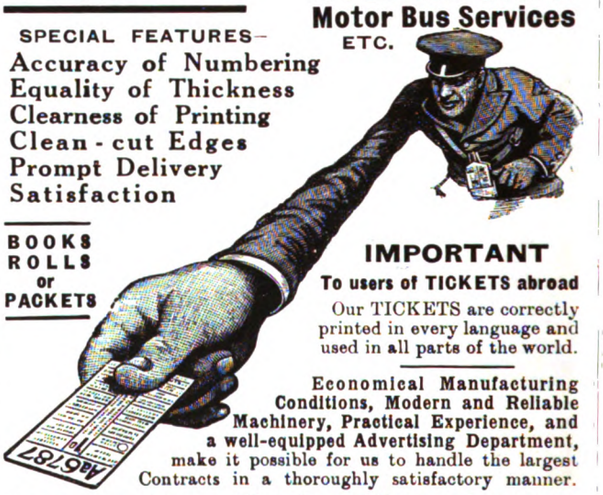

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To users of TICKETS abroad

Our TICKETS are correctly printed in every language and used in all parts of the world.

Economical Manufacturing Conditions, Modern and Reliable Machinery, Practical Experience, and a well-equipped Advertising Department, make it possible for us to handle the largest Contracts in a thoroughly satisfactory manner.

YOUR TICKET CONTRACT will expire, and if you send us samples, stating quantity used annually, you will place your future orders with us when you compare our quality and prices :

THE VISIBLE HAND PUNCH—to cut out round hole

This is the best Visible Punch on the market, and it cannot fail to give absolute satisfaction. The special feature of this Punch is that you can see exactly where you are punching the Ticket. Specially adapted for cancelling times, dates, &c. in the body of the Ticket.

Inspector's Ticket Nippers and Punches of every description

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HAS COME TO STAY, HAVING PROVED
TO BE FAR MORE SATISFACTORY THAN

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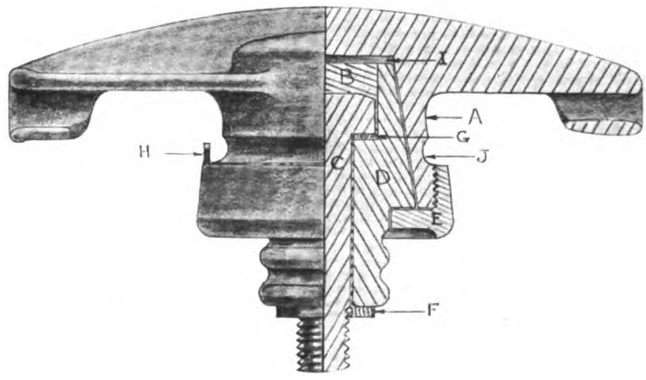

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"COX" TYPE.

A—Body or Frame. B—Filling. C—Steel Bolt. D—Insulator (Vitreous Porcelain).
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All Bolts are Interchangeable and screwed $\frac{5}{8}$ in. or $\frac{3}{4}$ in. Whitworth.

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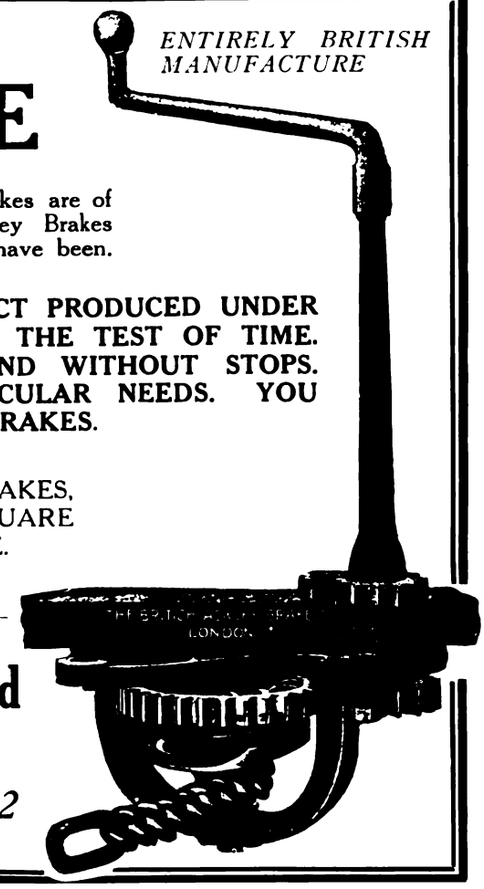
THE

ACKLEY BRAKE

ENTIRELY BRITISH MANUFACTURE



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Manufactured by Bridgeport Brass Co.

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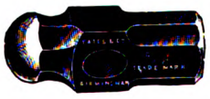

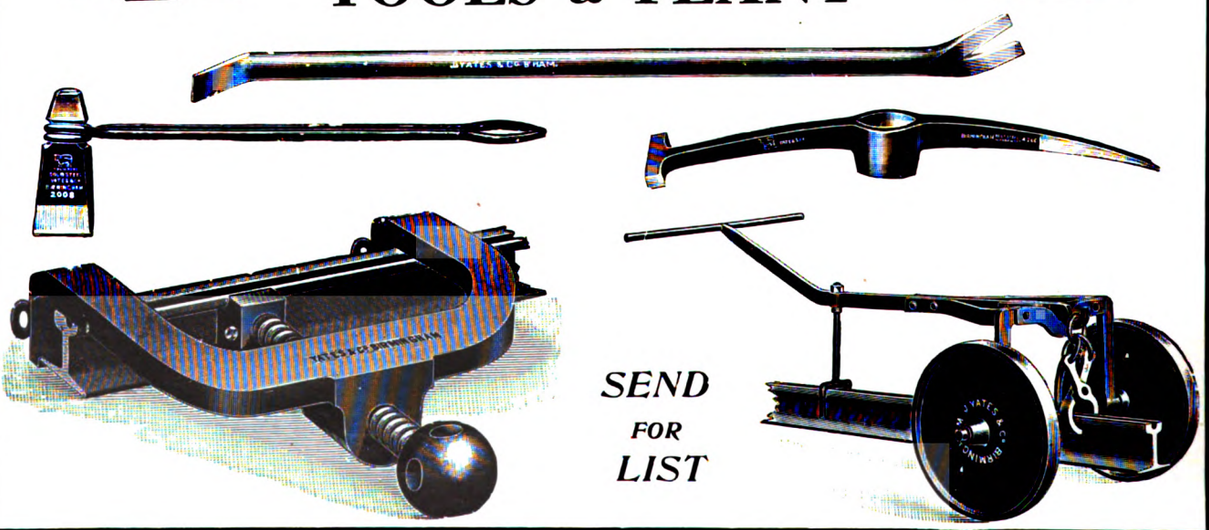

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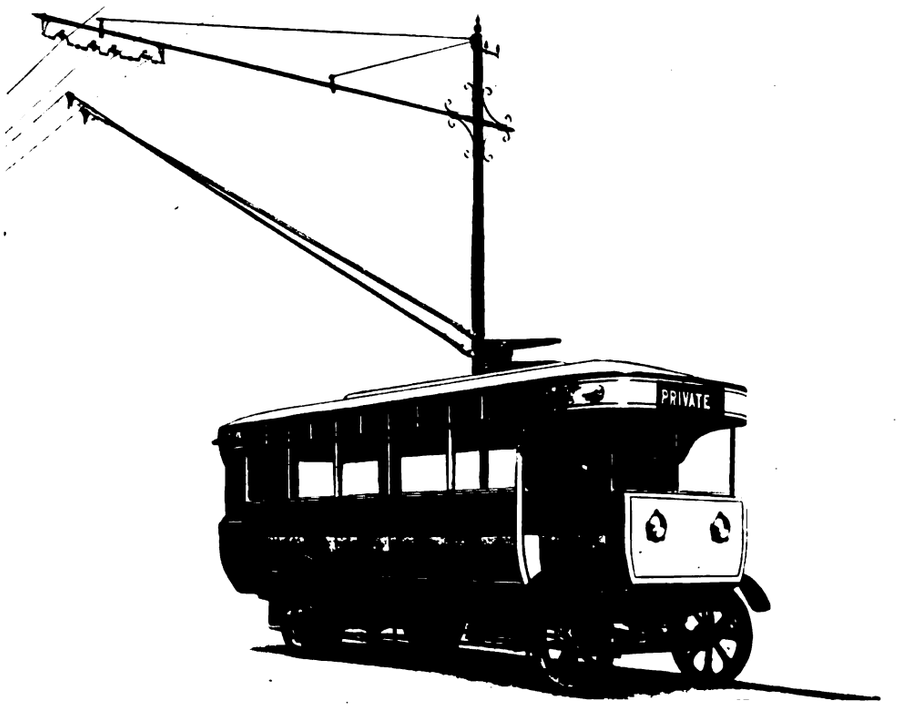

Our vehicle has established

AN ELECTRIC TRACTION RECORD

upon the Tees-Side Railless Traction System where operating costs have been reduced to under—

12½ pence per Trolley Omnibus Mile

Compare this figure with your own Trolley Omnibus, Petrol Omnibus, or Tramway results.

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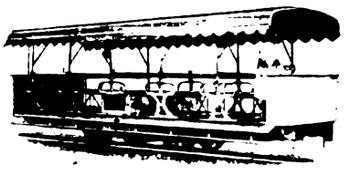
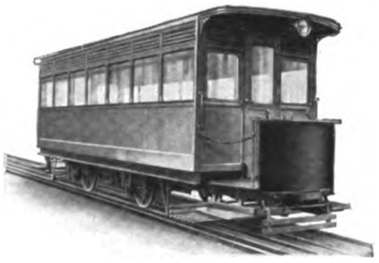
BUILT FOR ALL GAUGES AND CLIMATES

Simplex Cars have no Unsprung Axle Weights





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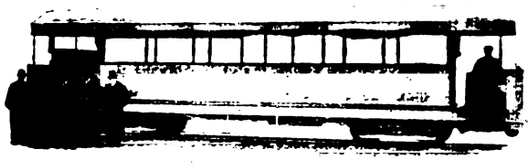

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Enquiries solicited

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is recognised by the majority of Railways throughout the World as a powerful and thoroughly reliable stopping device. It is equally suitable

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Osram Traction Lamps (spiralised filament type) are specially designed to withstand the rough usage, vibration and voltage fluctuations and other severe conditions met with in traction service

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Advt. of The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C. 2

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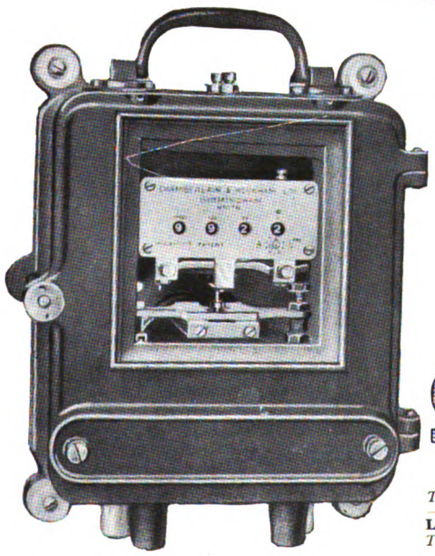
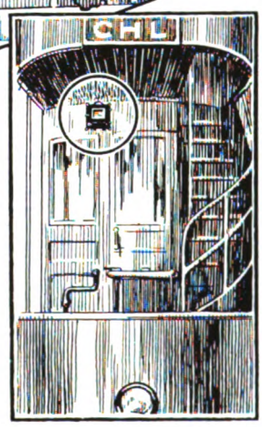


Chamberlain & Hookham

TRAMWAY METERS



Save Coal Save Current
Reduce Repairs
Eliminate Wasteful Running
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Available for all Tramway Voltages

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Builders and Repairers of

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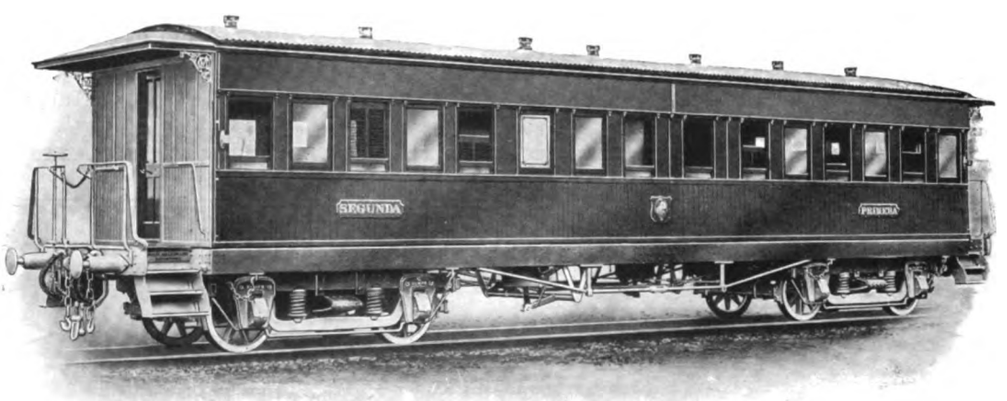

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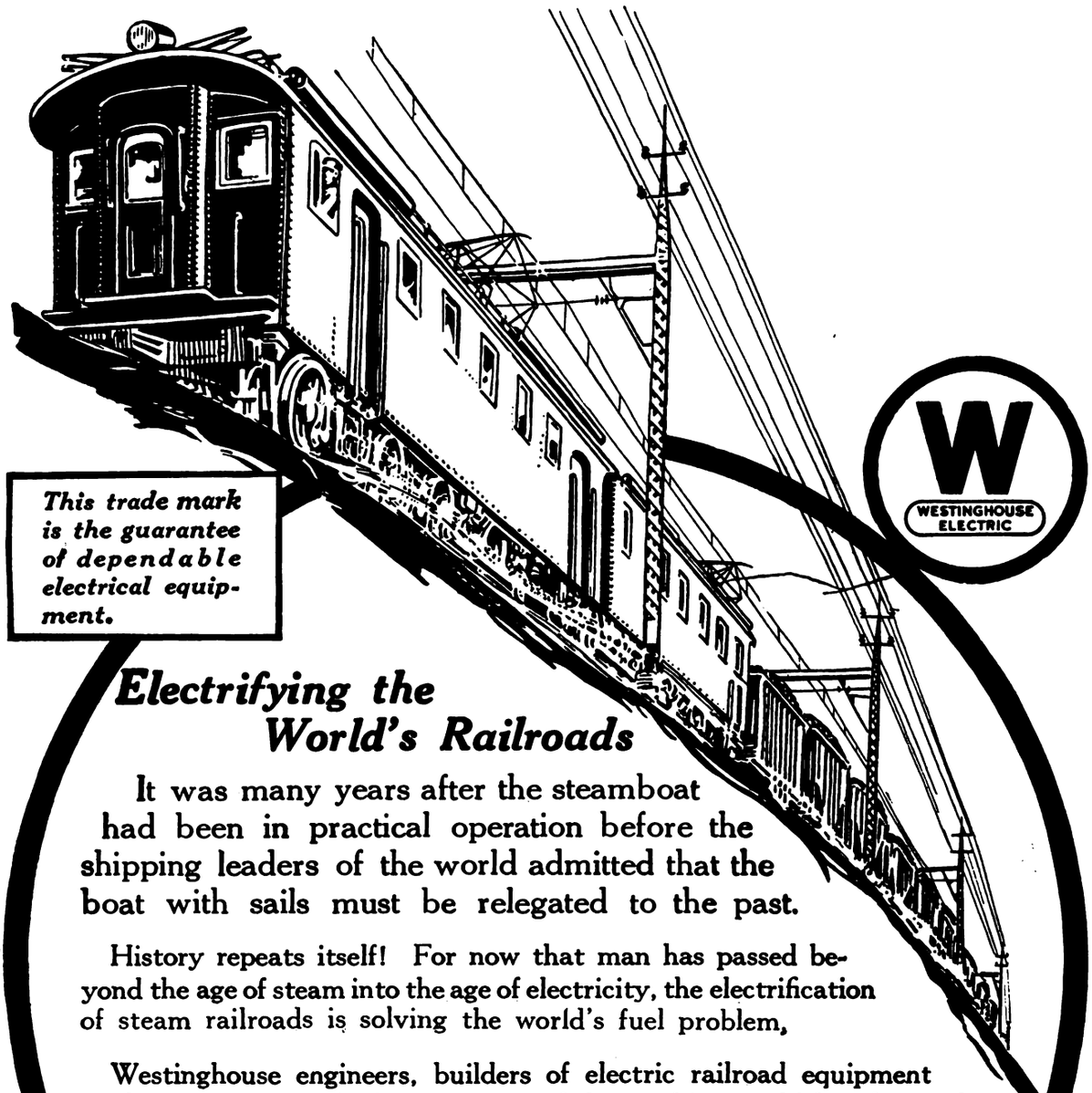

This trade mark is the guarantee of dependable electrical equipment.

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Electrifying the World's Railroads

It was many years after the steamboat had been in practical operation before the shipping leaders of the world admitted that the boat with sails must be relegated to the past.

History repeats itself! For now that man has passed beyond the age of steam into the age of electricity, the electrification of steam railroads is solving the world's fuel problem,

Westinghouse engineers, builders of electric railroad equipment and leaders in their field, have designed the machinery which is destined to make the steam engine a memory.

The Westinghouse Trade Mark on electrical equipment of any kind is the safeguard of the purchaser.

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19

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Commercial Motor Vehicles
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Don't be misled by Low First Cost!

IT is bad business to buy a low-priced vehicle that will give unsatisfactory service and be in dock perhaps just when you need it most.

Karrier passenger vehicles sell on quality. Their reputation is built on 16 years of unfailing service. Yet their prices are keenly competitive.

Powerful, simple, economical and absolutely trustworthy. Karrier passenger vehicles give most working days per year. You can depend upon them in all weathers and all road conditions.

Karrier passenger vehicles are made in all models to carry from 14 to 50 passengers, and range in chassis price from £465 upwards.

Let us know your needs and we will advise you what model will give you the best results for your particular purpose.

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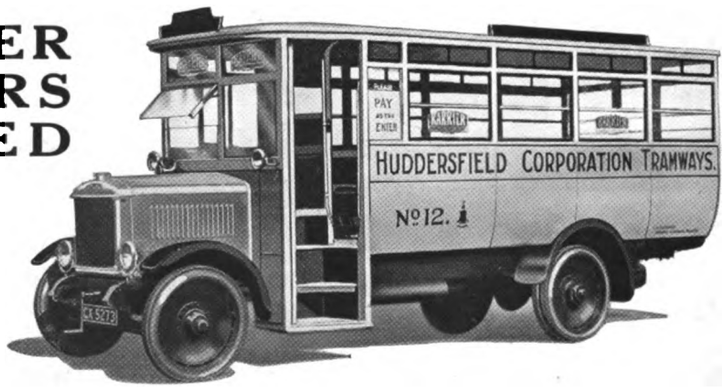

Municipalities are invited to write for details of the Karrier Road Sweeper, the only sweeper which sprinkles, sweeps and collects in one operation.

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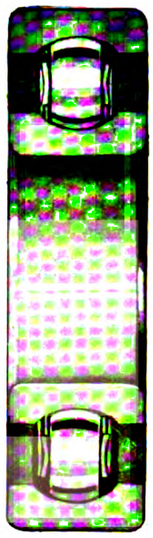

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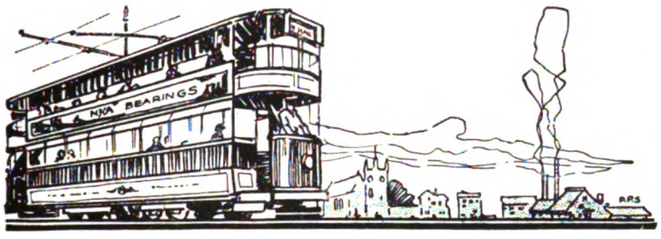
N.K.A. Patent Disc Bearings are proving themselves to be the ideal Bearings for Tramway and Railway rolling stock. Besides being used in Great Britain, they are supplied to Tramway Companies in Holland, Argentina, Finland and Sweden. They are **the** Bearings for heavy duty.

Our Technical Department will gladly advise you upon the most suitable bearing for your requirements. We invite your enquiries.



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Branches at Coventry, Lincoln, Manchester, Glasgow, Cardiff, Bedford, Leeds and Dublin

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Some of the Countries and British Dominions

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. . CAST IRON . .

Dawson-Ferranti Patent, Application 33290-20.

NO-MAG HAS ELECTRICAL RESISTANCE HIGHER THAN IRON AND PERMEABILITY AS LOW AS BRASS.

	Magnetic Permeability Maximum	Specific Resistance – Micro-ohms per cm. cube
Ordinary Cast-Iron..	330·00	95·0
"No-Mag"... ...	**1·03**	**140·0**
Brass...	1·00	7·5

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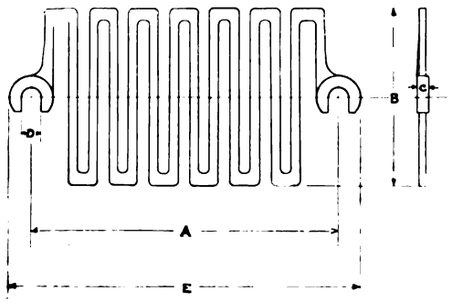
OF THE FOLLOWING DIMENSIONS ARE NOW AVAILABLE IN FIVE SIZES



	Ins.
A	$9\frac{1}{2}$
B	$5\frac{1}{2}$
C	$\frac{3}{8}$
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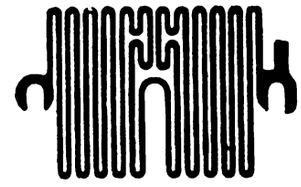
E	$10\frac{7}{8}$

Bending Test.

GRIDS ALSO MADE FROM CUSTOMERS' OWN PATTERNS.



FERRANTI LIMITED, HOLLINWOOD, Lancs.

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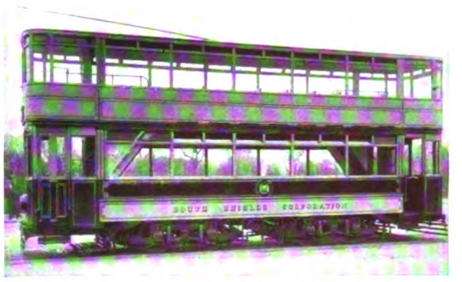


WHERE the tendency is for larger cars, equal-wheeled bogies call for notice. Here is a heavy top-decker mounted on Brill No. 76-E trucks. One motor per bogie—outside-hung brake-shoes and magnetic track brakes.

Normally a bogie for a 4-motor car. Will carry up to 22 tons. 65-h.p. motors. Speeds 30 m.p.h.

A truck with character.

Rugged strength in the solid-forged side-bars.

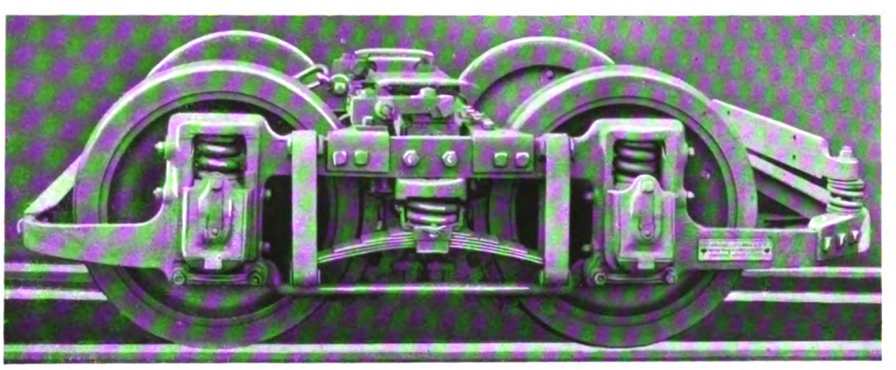
Correct suspension in the Brill Graduated Spring System. Coil spring takes the light loads, transferring to the long semi-elliptic as car fills up; the whole suspended on long swinging links from the side-bars. Track irregularities absorbed by journal coil springs.

Note the Bolster Guide. It has abolished chafing plates—friction—binding of bolster and lost motion at this point.

A truck made to endure—low maintenance—real riding comfort.

Detailed in Bulletin No. 225.

Brill No. 76-E



THE J. G. BRILL COMPANY
150 Southampton Row LONDON W C 1
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FMB

MEANS RELIABILITY

The old old festival

approaches once again, and the whole atmosphere seems charged with a kindlier current. The hurly-burly of modern business life tends to dispel much of that spirit which is both the foundation & the coping stone of Christmastide, yet we are glad to think that from year's end to year's end our relations with our customers continue on a footing of friendship and mutual consideration. Here, however, is an opportunity to accentuate those friendships—often the best & strongest in Life's history—and, while we are all tuned to the softer radiations of this time-honoured festival, we desire to broadcast to all our customers the same old wish, in the same old spirit & the same old words.

A merry Christmas
& a prosperous New Year.

Johnson & Phillips Ld Charlton London S.E.7.
City Offices & Stores: 12 Union Court, Old Broad St. E.C.2

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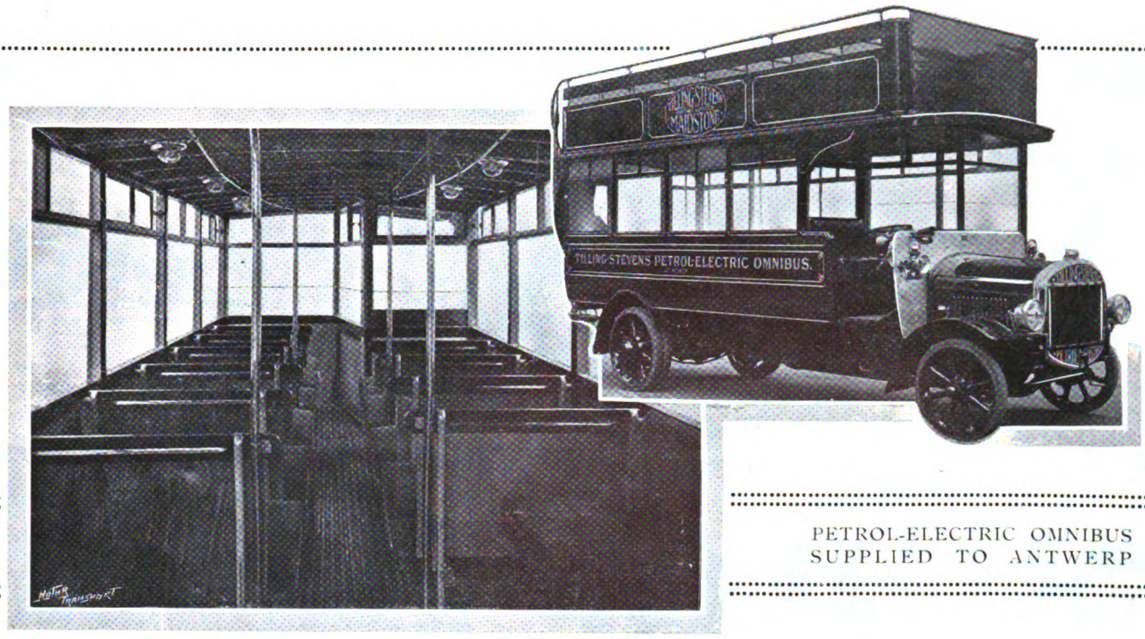

PETROL-ELECTRIC OMNIBUS
SUPPLIED TO ANTWERP

If you use Petrol-Electrics you satisfy both your passengers and your pocket

MUTUAL satisfaction is derived from the operation of Tilling-Stevens Petrol-Electric 'Buses. The entire absence of all jarring in stopping and starting gives that feeling of comfort to the passengers equivalent to travelling in a saloon. Passengers sense in some indefinable way that in the Petrol-Electric the last thing in passenger travel has been attained.

Petrol-Electric 4-ton load, or 30-57 passengers T.S.3a	**£1,160**
Petrol-Electric 2-ton load or 20-25 passengers T.S.5	**£860**
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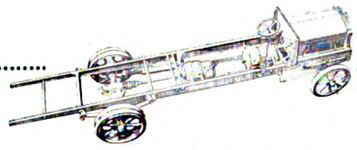
5-ton Gear-driven T.S.B.3	**£840**



This is the Petrol-Electric Chassis; it has no gears and no clutch; it is economical to run; it provides greater comfort for passengers. For 'bus work it is in use in more municipalities than any other make. Why not write for full particulars?

The elimination of the disadvantages of the gear-driven vehicle, i.e., clutch and gears, makes for better and more profitable 'bus transport. The smooth jerkless running of the Tilling-Stevens Petrol-Electric gives greater tyre mileage and increased chassis life, thus lowering operating costs, with mutual benefit to yourself and passengers.

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London Office—26 Victoria St. SW1

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TILLING-STEVENS PETROL-ELECTRIC

A User says—

THE · PETROL-ELECTRIC · GLIDES · LIKE · A · YACHT

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SCIENTIFIC research plays a large part in the manufacture of the

DUNLOP
SOLID RUBBER TYRE

to the big advantage of the user.

Constant test and experiment, and unremitting supervision, ensure that only the finest tyre which modern science, supreme technical skill, and perfect equipment can produce, leaves the Dunlop mills.

The buyer of Dunlop "solids" reaps the reward of research, and is assured always of

"SOLID" SATISFACTION

DUNLOP

- Standard solid tyres for use as single or twin equipment.
- "Giant Single" solid tyres, for rear wheels.
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DUNLOP SOLID RUBBER TYRES

OBTAINABLE FROM ALL MOTOR DEALERS.

WHOLESALE DISTRIBUTION AND SOLID TYRE FITTING DEPOTS:—Aberdeen, Belfast, Birmingham, Bristol, Coventry, Dublin, Edinburgh, Glasgow, Leeds, Liverpool, London, Manchester, Newcastle-on-Tyne, Norwich, Nottingham.

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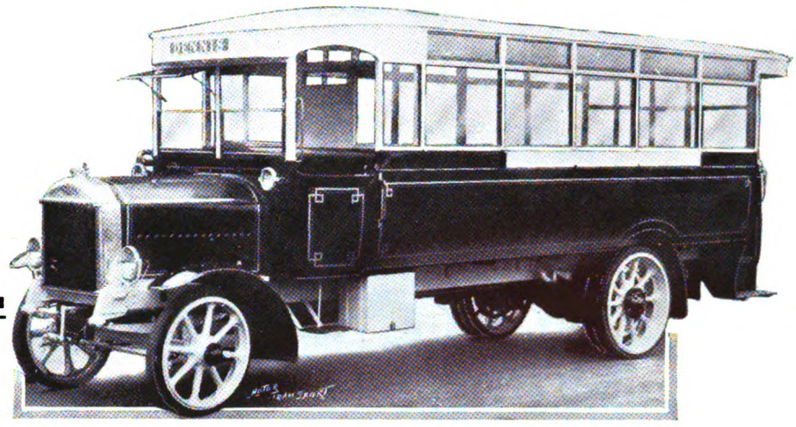

A Dennis 36-seater single-deck Omnibus

" . . I feel compelled to further praise the wonderful running of your machines "

SO writes Mr. W. K. Wynne, of Wellington Garage, Hanley, who also states in his letter that his 28-seater "Dennis" Motor Coach has now completed

14,000 MILES WITHOUT A MINUTE'S TROUBLE OF ANY DESCRIPTION

"My coach," he says "is well known throughout the district for its sweet running and reliability. I am in no way connected with your firm, just a GENUINE SATISFIED USER (3 years) of 'DENNIS' machines, and in saying this I am sure that I am voicing the feeling of several owners in the district."

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30 cwt. Chassis
£550

2-2½ ton Chassis
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40 h.p. Motor Coach Chassis
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Write for catalogue of our full range of passenger-carrying machines with seating capacity from 14 to 54 persons.

DENNIS BROS. LTD. GUILDFORD

Manufacturers of the famous Dennis Turbine Motor Fire Engines

DENNIS

BUILD BETTER 'BUSES

A smart "Dennis" 33-seater front entrance, single-deck Omnibus

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WHERE equipment is concerned the Best is ECONOMY, and economy in running cost is equivalent to profit in the passenger carrying business.

When the question of wheel selection comes up for consideration the strong economy claims of the "S. & C." Patent Steel Disc Wheel commands a hearing.

It is Light, It is Neat, It is Strong, It is Resilient, and above all it is Reliable.

Each point has an obvious result on running cost –

ECONOMY THEREFORE TRY THEM

IMMEDIATE DELIVERY

SO WRITE TO-DAY FOR PRICES

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"Bristol"

OMNIBUSES

used on regular services over 700 miles of road, are the outcome of years of experience gained by the largest transport organisation in the West of England. The latest type of saloon omnibus, with separate doors for entrance and exit, and a smoking compartment, is the ideal passenger service vehicle.

For reliability with unsurpassed economy the

"BRISTOL"

vehicle stands pre-eminent.

Send for a specification, but better still arrange a demonstration.

Manufactured by

The BRISTOL TRAMWAYS & CARRIAGE Co. Ltd.
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After Eighteen Months' Experience

CARDIFF
CITY TRAMWAYS

again order

STEVENS

PETROL-ELECTRIC
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for their

New Omnibus Services

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IF YOU HAD run a Rebuilt R.A.F. Leyland for several seasons there would be not the least need for further convincement of their present remarkable value.

Such well-known companies as Shell, Maple, Cadbury, Bradford Dyers, Hovis, Pickford, Scottish Oils, L. & N.W.R. &c. have shown their satisfaction by substantial repeat orders for Leyland "Rebuilts."

The 4-ton Rebuilt R.A.F. Leyland at £590 chassis price, including a full six-month guarantee, is certainly in a class by itself.

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LEYLAND MOTORS LTD. *Head Office and Works—* LEYLAND LANCS.

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MOTOR BODIES FOR ALL PUBLIC SERVICES

FOR HOME AND EXPORT

Double-Deck 'Bus Body, C.D.22 Model, incorporating our latest construction increasing interior width to 6 ft. 11 in., whilst retaining an exterior width of 7 ft. 2 in.

OUR LEADING LINES

C.D.22 MODEL DOUBLE-DECK 'BUS BODY

For London or Provinces

This body is in constant production for all leading makes of Omnibus Chassis, and quick delivery can consequently be given. Seating capacity—22 passengers inside, 2 beside the driver, and 28 on roof seats.

C.D.19 MODEL SINGLE-DECK 'BUS BODY

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THE DODSON "CHARABUS" (Regd.) BODY

The "CHARABUS" is designed to comprise all the essential and desirable features of both Single-Deck Saloon 'Bus and Char-a-banc in one car. Seating capacity—28/42 passengers.

Open or closed in a few minutes.
Can be used all the year round.
Motor Coach in Summer.
Service 'Bus in Winter.
Daylight riding as Char-a-banc, return at night in a comfortable, well-illuminated 'Bus.
Easy access to all seats.
Provision for luggage.

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Telephone—**Willesden 1630 (two lines)** *Telegraphic Address*—**Ceedolim Willroad London**

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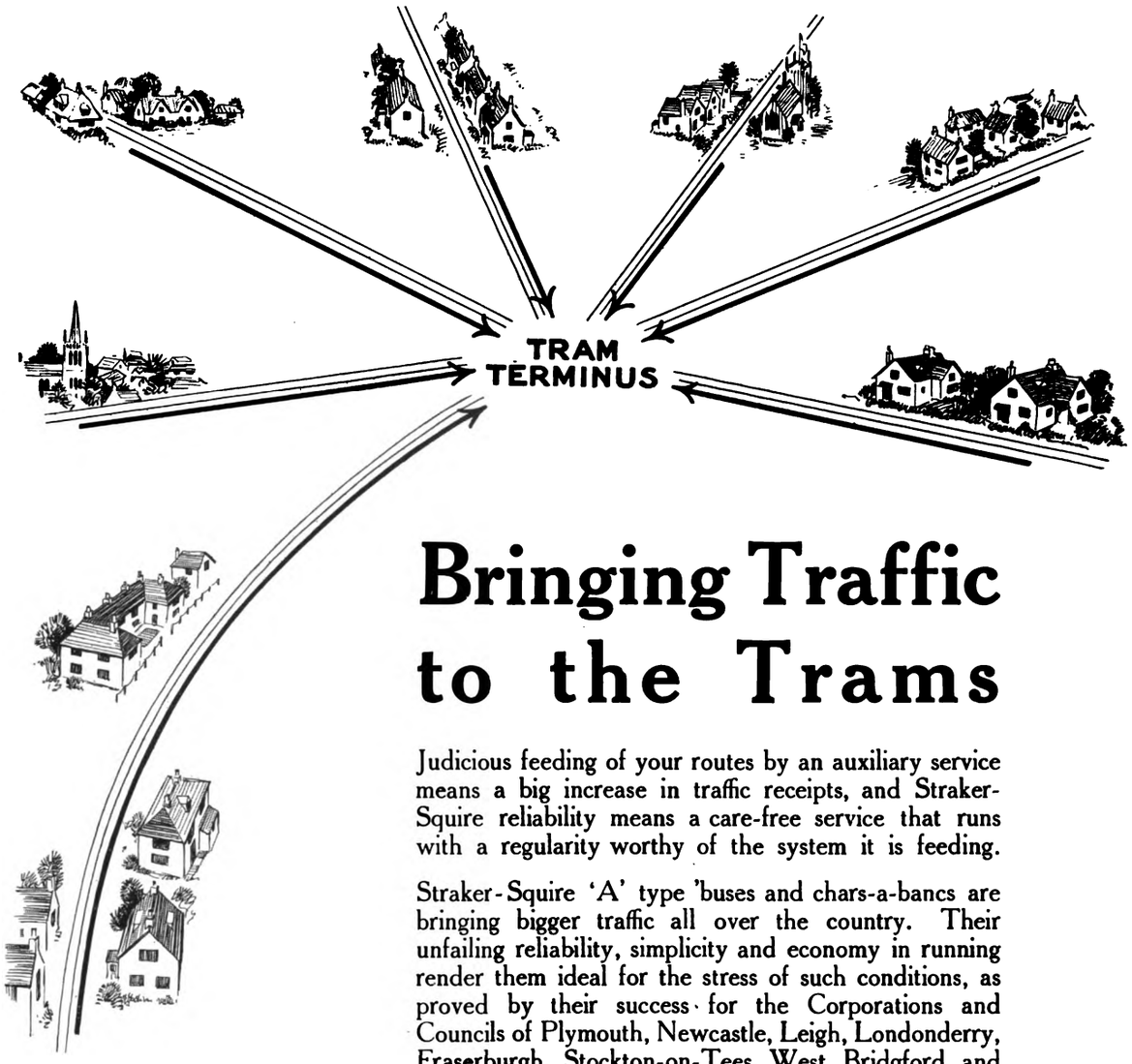

Bringing Traffic to the Trams

Judicious feeding of your routes by an auxiliary service means a big increase in traffic receipts, and Straker-Squire reliability means a care-free service that runs with a regularity worthy of the system it is feeding.

Straker-Squire 'A' type 'buses and chars-a-bancs are bringing bigger traffic all over the country. Their unfailing reliability, simplicity and economy in running render them ideal for the stress of such conditions, as proved by their success for the Corporations and Councils of Plymouth, Newcastle, Leigh, Londonderry, Fraserburgh, Stockton-on-Tees, West Bridgford and many others.

Write for complete catalogue and full particulars.

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STRAKER-SQUIRE LTD **EDMONTON, LONDON N 18**

Telephone—TOTTENHAM 2393 (5 Lines) *Telegrams*—"RHOMBOIDAL TOTTLANE LONDON"

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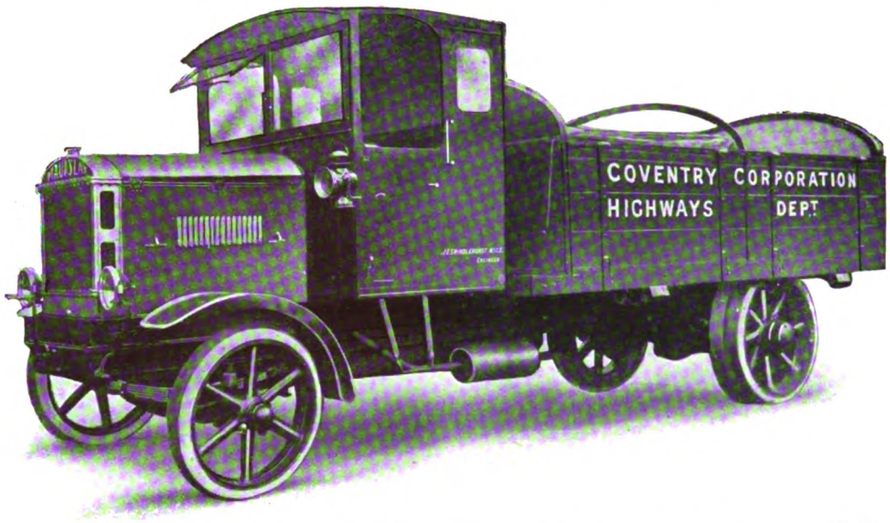

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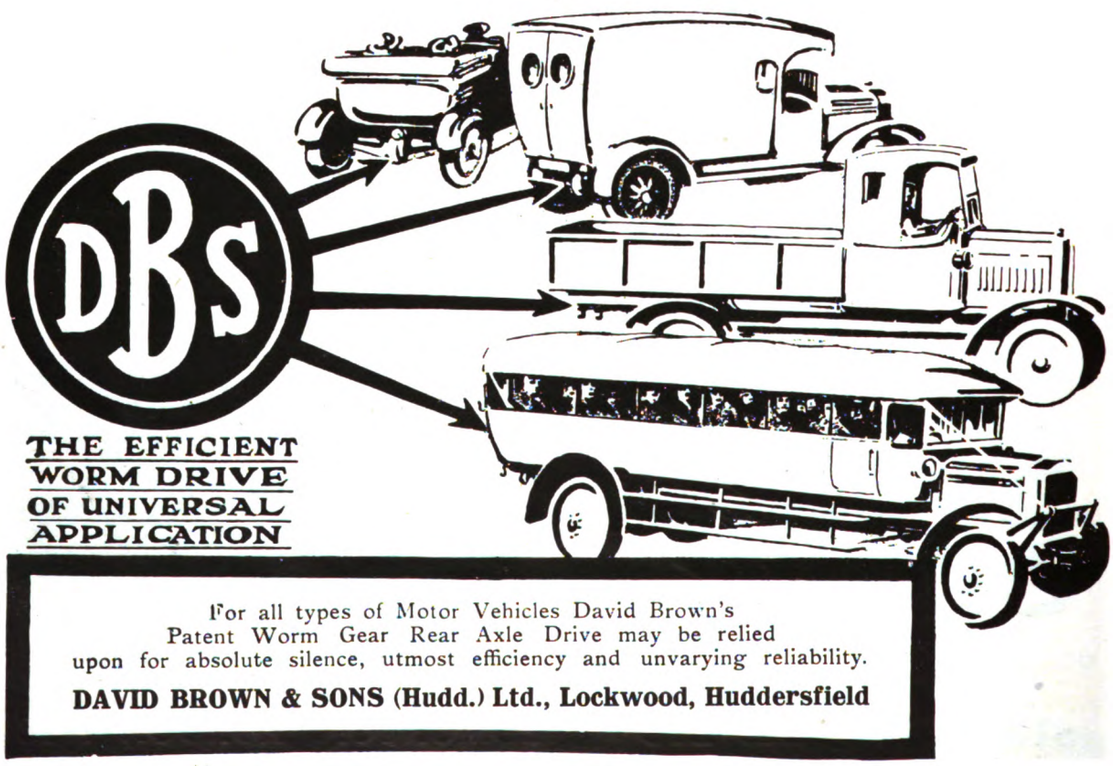
THE MAUDSLAY MOTOR CO LIMITED — COVENTRY

LONDON OFFICE— — — — — — 89 UNION GROVE S.W.8

CAPACITY UP TO SEVEN TONS



For all types of Motor Vehicles David Brown's Patent Worm Gear Rear Axle Drive may be relied upon for absolute silence, utmost efficiency and unvarying reliability.

DAVID BROWN & SONS (Hudd.) Ltd., Lockwood, Huddersfield

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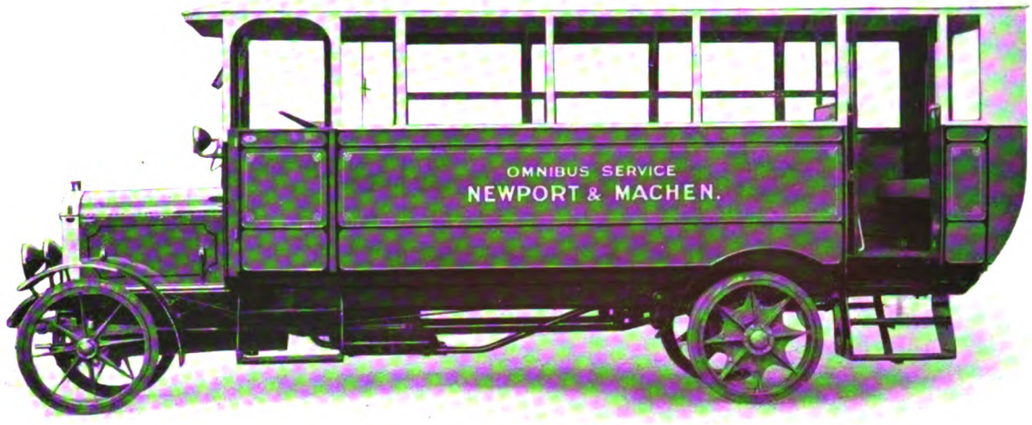

FOR Urban and Country District Services, Station work &c., this single-decked, 25-seater Thornycroft Motor Omnibus is eminently suitable on narrow roads. The chassis is our long wheelbase model specially constructed for passenger service

The chassis is a 30-h.p. Thornycroft Type BT as awarded the Dewar Trophy by the Royal Automobile Club for "the most meritorious performance of the year" after an observed trial of 1,260 miles with a full 2-ton load.

THORNYCROFT

PASSENGER MOTOR VEHICLES

The best auxiliaries to existing services and most profitable investments for new or extension routes.

Write for Catalogue TCY233 of Passenger Vehicles

JOHN I. THORNYCROFT & CO.
LIMITED
THORNYCROFT HOUSE, SMITH SQUARE
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A few more Reports on the service of ELECTRICARS' Vehicles to the Chairman of the Electric Vehicle Committee of Great Britain.

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(Mr. J. Terry, *Cleansing Superintendent*).

"The two 3-ton vehicles are used for collecting immediately round the depot, the furthest distance being about 1½ miles. I find on this distance they show a saving of something like 9d. per ton over that of horse vehicles."

PONTYPRIDD U.D.C.
(Mr. W. E. Lowe, *Engineer and Surveyor*).

"I have found them very satisfactory, and most suitable for the class of work for which they are used."

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(Mr. T. Cookson, *Borough Engineer*).

"During the time these vehicles have been in use by us they have fulfilled all expectations. They have been out *six days per week* and are *still in perfect order*."

TAUNTON
(Mr. I. F. Shellard, *Borough Engineer and Surveyor*).

"Having had experience with both petrol lorries and electric vehicles, I am convinced that the former cannot compare with the latter both from the point of view of *cost and efficiency*, and in my opinion the electric vehicle is in every way *most suitable for refuse collection*. The electric vehicles have done most useful work in the general hauling, such as stone from station &c., and undoubtedly have shown a *considerable saving in cost* in comparison with horse-drawn vehicles."

Part of the Islington Borough Council's Fleet of Edison Accumulator Tip Wagons.

Write for full particulars.

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100,000 SQ. FT.

of floor space equipped with modern machinery for the quantity production of

Commercial Vehicles

Our deliveries for one firm alone have totalled over

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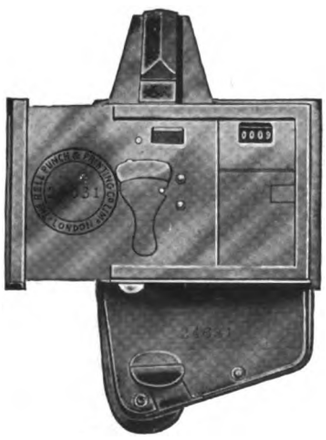

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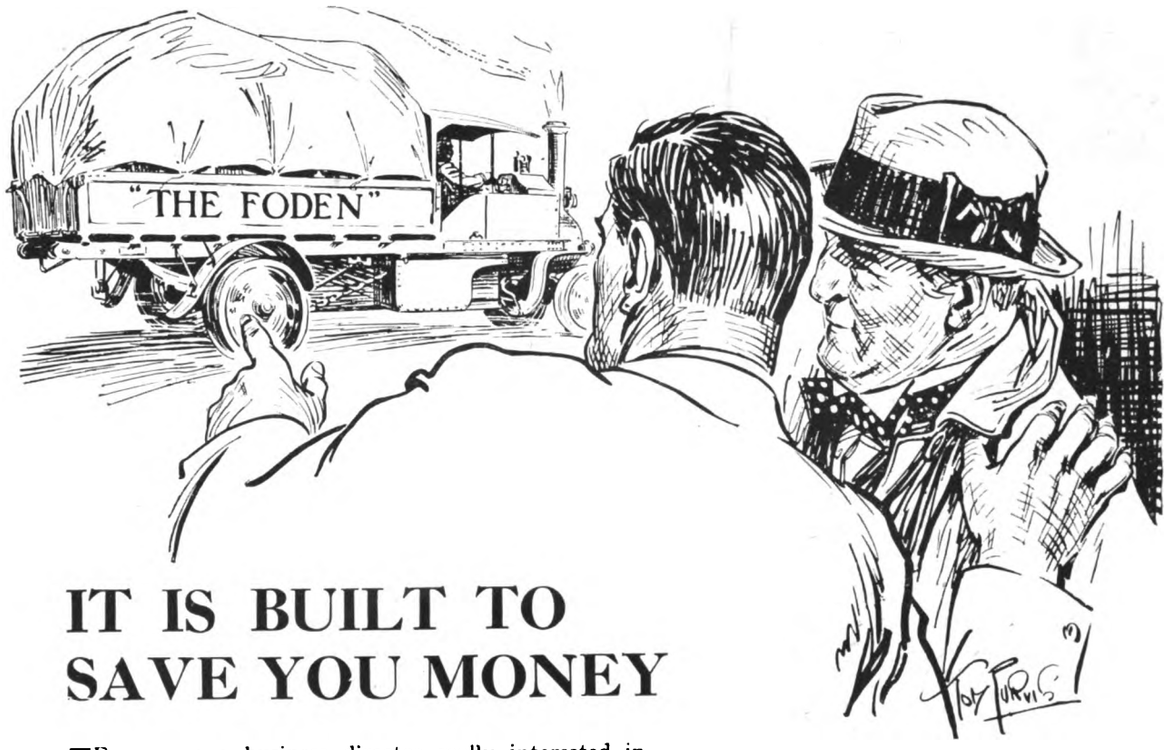

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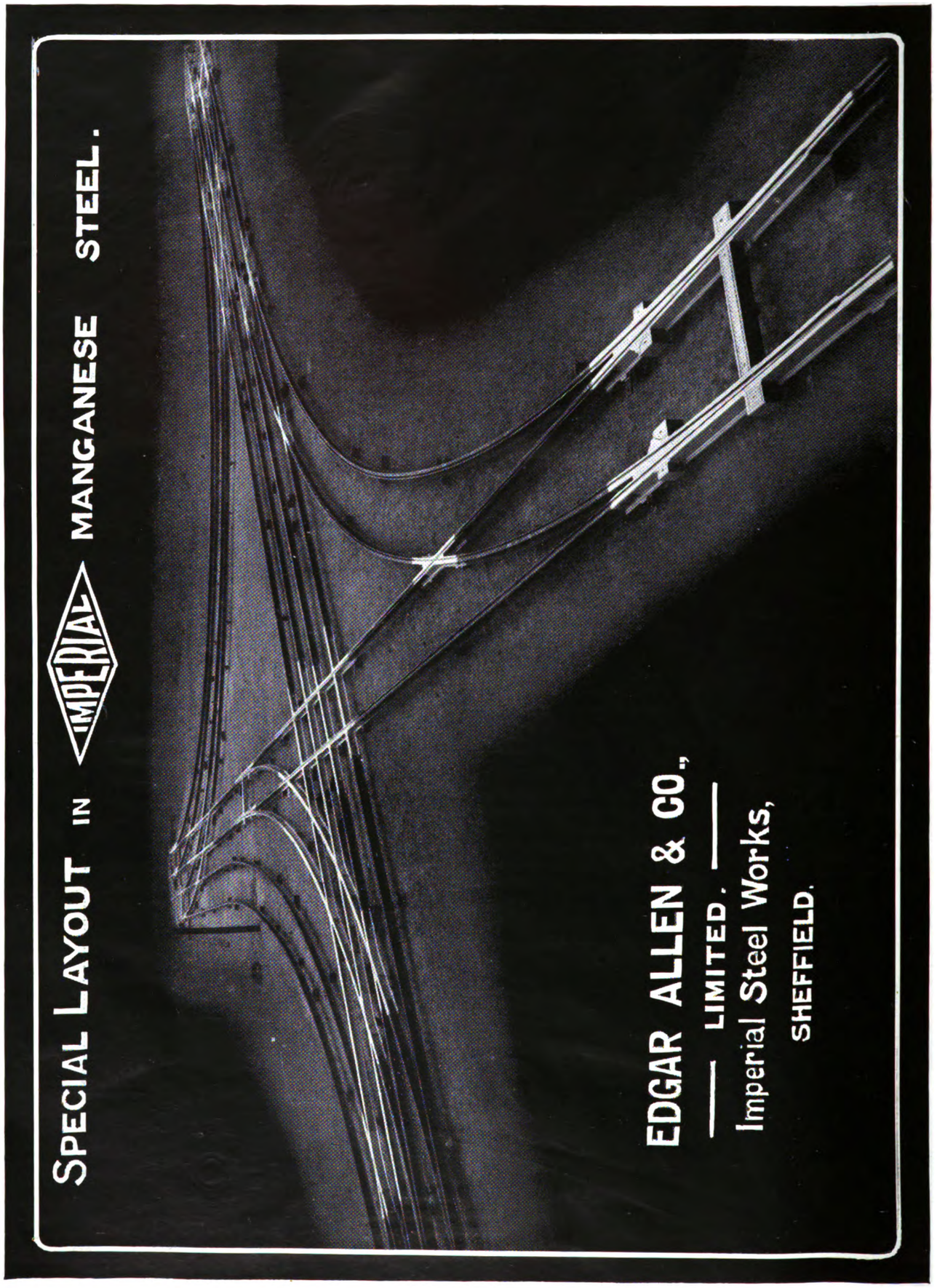

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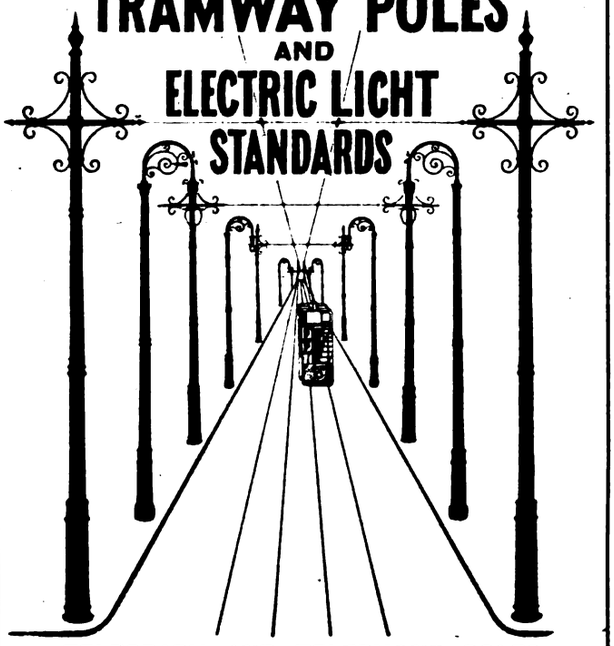

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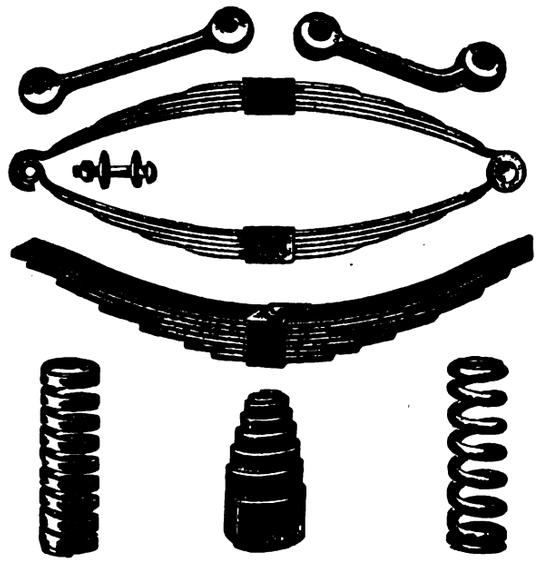

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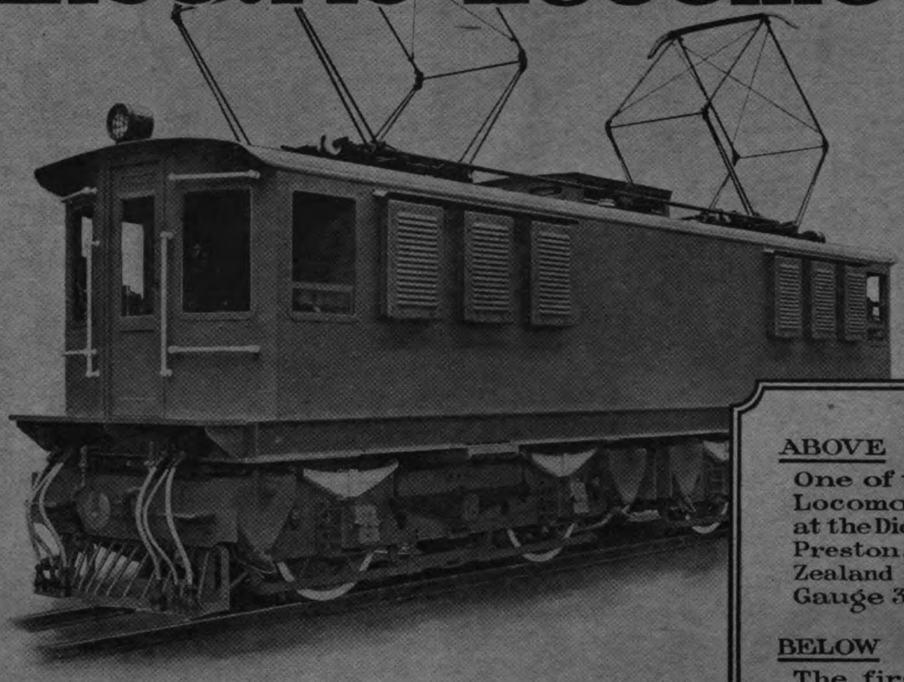
Main Line Electric Locomotives



ABOVE

One of the Electric Locomotives built at the Dick, Kerr Works, Preston, for the New Zealand Government. Gauge 3'6".

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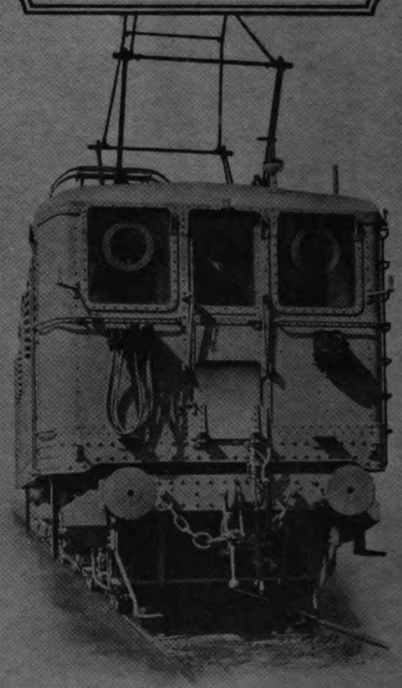

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